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Annual Report of the
National Institutes of Health

PROGRAM IN BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING FISCAL YEAR 1981

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NIH Nutrition
Coordinating Committee

U.S. DEPARTMENT OF
HEALTH AND HUMAN SERVICES
Public Health Service
National Institutes of Health

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Annual Report of the
National Institutes of Health

PROGRAM IN BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING FISCAL YEAR 1981

Prepared by
NIH Nutrition
Coordinating Committee

U.S. DEPARTMENT OF
HEALTH AND HUMAN SERVICES
Public Health Service
National Institutes of Health

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CONTENTS

Page

THE MEMBERSHIP OF THE NUTRITION COORDINATING COMMITTEE vii

ACKNOWLEDGEMENTS ix

PREFACE xi

I. THE FY 1981 PROGRAM IN BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING 1

- DEFINITION OF NUTRITION RESEARCH AT THE NIH 3
- FY 1981 OBLIGATIONS FOR NUTRITION RESEARCH AND TRAINING 3
  - Overview of the Nutrition Program 3
  - Comparison of Nutrition Program with Overall NIH Program . . . 10
- THE CLINICAL NUTRITION RESEARCH UNITS 11
- THE EXTRAMURAL PROGRAM 12
  - The Research Program 12
  - Manpower Development 20
  - Program Development 22
  - Nutrition Conferences Sponsored by the NIH 29
- INTRAMURAL RESEARCH PROGRAM 31
- NUTRITION RESEARCH TRAINING 37
  - Extramural Training 38
  - Intramural Training 41
- HIGHLIGHTS OF SPECIAL INTEREST AREAS IN NUTRITION 42
  - Nutrition and Prevention of Disease 44
  - Nutritional Status 48
  - Behavioral Studies in Nutrition 52
  - Child and Infant Nutrition 55

Page

- Research on Vitamins 59
- Epidemiological Research in Nutrition 63
- Nutrition and Obesity 65
- Nutrition and Genetics 69
- Total Parenteral and Enteral Nutrition 73
- Nutrition and Aging 75
- Maternal Nutrition 77
- International Research in Nutrition 79
- Nutrition Education for Professionals 83
- Nutrition Education for the Public 84
- Nutrition Education Research 87

II. NUTRITION COORDINATING COMMITTEE 91

- COMMITTEE STRUCTURE 93
- COMMITTEE ACTIVITIES AND ACCOMPLISHMENTS 94
  - Scientific Seminars 94
  - The Videotape Series, "EAT WELL, BE WELL" 103
  - Conferences Sponsored by the NCC 105
- SUBCOMMITTEE ON NUTRITION EDUCATION ACTIVITIES AND ACCOMPLISHMENTS . . 107
  - Expanded Foods for Health Project 107
  - National Nutrition Month at the NIH, March 1981 107

III. NUTRITION COORDINATING COMMITTEE OFFICE 111

- ACTIVITIES OF THE NCC OFFICE 113
  - Congressional Hearings on Nutrition 113
  - Official Reports and Special Presentations on Nutrition 115
  - The NCC Office-Clinical Center Study on the Long-Term Effect on Infants of Hypochloremic Metabolic Alkalosis Resulting from Infant Formulas Deficient in Chloride 116

Page

DHHS Nutrition Coordinating Committee/Policy Board and the Subcommittee on Nutrition Research and Research Training . . . 117

DHHS Nutrition Research Initiative 117

The Joint Subcommittee on Human Nutrition Research (JSHNR) of the Federal Coordinating Council for Science, Engineering and Technology (FCCSET), Office of Science and Technology Policy (OSTP), Executive Office of the President 119

IV. APPENDICES 123

A. NUTRITION POLICY OF THE NIH 125

B. MANDATE OF THE NIH NUTRITION COORDINATING COMMITTEE 127

C. FY 1981 NUTRITION EXPENDITURES BY INSTITUTE AND DIVISION 129

D. NIH FY 1983 PRIORITIES IN NUTRITION RESEARCH AND RESEARCH TRAINING . 141

E. LEGISLATIVE AUTHORITY OF NIH FOR HUMAN NUTRITION RESEARCH 157

LIST OF TABLES

Page

I. NIH Biomedical and Behavioral Nutrition Research and Training, FY 1981, by Category of Support 4

II. Support Mechanisms for Clinical Trials, FY 1981 6

III. Interagency Reimbursement Agreements with Nutrition Research Components Funded by the NIH in FY 1981 8

IV. Comparison of Total NIH and Nutrition Obligations in the Three Major Components of Extramural Research, FY 1981 10

V. PA's, RFA's, and RFP's in Nutrition Research and Training Published in The NIH Guide for Grants and Contracts, FY 1981 23

VI. NIH Sponsored Nutrition Conferences, FY 1981 30

VII. NIH Training in Nutrition, FY 1981 37

VIII. Comparison of Total NIH and Nutrition Program Support of Extramural Research Training, FY 1980 and FY 1981 38

IX. Special Interest Areas in Nutrition--Summary Table 43

LIST OF FIGURES

1. FY 1981 Expenditures of NIH Program in Biomedical and Behavioral Nutrition Research and Training, by B/I/D 9

THE MEMBERSHIP OF THE NUTRITION COORDINATING COMMITTEE*

Officers

Chairman	Artemis P. Simopoulos, M.D.
Consultant	Van Hubbard, M.D., Ph.D. (Intramural NIADDK)

Members and (Alternates)

Division of Research Resources	William R. DeCesare, M.D. (Maria A. Mannarino M.D.)
Division of Research Services	Joseph J. Knapka, Ph.D.
National Cancer Institute	Andrew Chiarodo, Ph.D. (Seoras Morrison, Ph.D.)
National Eye Institute	Henry Fukui, Ph.D. (Ralph Helmsen, Ph.D.)
National Heart, Lung, and Blood Institute	Nancy Ernst (Basil M. Rifkind, M.D.)
National Institute on Aging	Elizabeth A. McGuire, Ph.D. (Leonard F. Jakubczak, Ph.D.)
National Institute of Allergy and Infectious Diseases	Robert Edelman, M.D. (Alfred M. Webb, Ph.D.)
National Institute of Arthritis, Diabetes, & Digestive & Kidney Diseases	Gerald Combs, Ph.D. (John G. Bieri, Ph.D.)
National Institute of Child Health and Human Development	Gilman D. Grave, M.D. (Thorsten Fjellstedt, Ph.D.)
National Institute of Dental Research	David A. Wolff, Ph.D. (Sharon L. Johnson, Ph.D.)
National Institute of Environmental Health Sciences	Wilford L. Nusser, Ph.D. (Carol M. Schiller, Ph.D.)
National Institute of General Medical Sciences	Emilie A. Black, M.D.
National Institute of Neurological and Communicative Disorders and Stroke	Zekin Shakhashiri, M.D. (O. Malcolm Ray, Ph.D.)

---

*(Alternates in parenthesis)

As of September 30, 1981

NIH Liaison Representatives

Clinical Center	Elaine Offutt (Edith Jones)
Division of Computer Research and Technology	Penny Brogan (Arnold Pratt, M.D.)
Division of Legislative Analysis	Kay Holcombe
Division of Research Grants	John Schubert, Ph.D. (Julius A. Currie, Ph.D.)
Fogarty International Center	Phyllis Eveleth, Ph.D.
National Library of Medicine	Donald A. Merritt, M.D.
Office of Communication	Marc Stern

PHS, Department, and Other Liaison

Alcohol, Drug Abuse, and Mental Health Administration	Ellen Stover, Ph.D
Centers for Disease Control	Milton Nichaman, M.D.
Food and Drug Administration	Allan Forbes, M.D. (John Vanderveen, Ph.D.)
Division of Medicine, Health Resources Administration	Margaret Wilson, Ph.D.
National Center for Health Statistics	Robert Murphy
National Institute of Mental Health	Marian Yarrow, Ph.D.
Office of the Assistant Secretary for Health	Theodore B. Van Itallie, M.D.
Office of Science and Technology Policy, Executive Office of the President	Denis Prager, Ph.D.

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On behalf of the Nutrition Coordinating Committee I wish to thank four members of the NCC Office staff: Ms. Karen Donato for her excellent work in updating the annual report; Dr. Thomas Vogl for the extensive analysis of the program based on the computerized data retrieval system; and Mrs. Sherri Wisner and Mrs. Colleen Saur for their technical assistance in the final preparation of the report.

Artemis P. Simopoulos M.D.

Artemis P. Simopoulos, M.D.
Chairman, Nutrition Coordinating Committee
Office of the Director
National Institutes of Health

NIH Liaison Representatives

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Division of Research Grants	[illegible]
Fogarty International Center	[illegible]
National Library of Medicine	[illegible]
Office of Communications	[illegible]

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Centers for Disease Control	[illegible]
Food and Drug Administration	[illegible] [illegible]
Division of Medicine, Health Resources and Services Administration	[illegible]
National Center for Health Statistics	[illegible]
National Institute of Mental Health	[illegible]
Office of the Assistant Secretary for Health	[illegible]
Office of Science and Technology Policy, Executive Office of the President	[illegible]

PREFACE

The National Institutes of Health is the major agency in the Federal Government that supports research and training in nutrition as it relates to health maintenance, human development throughout the life cycle, disease prevention, and disease treatment. The NIH Program in Biomedical and Behavioral Nutrition Research and Training is supported by all 11 Institutes and one Division, namely:

NCI -	National Cancer Institute
NHLBI -	National Heart, Lung, and Blood Institute
NIDR -	National Institute of Dental Research
NIADDK -	National Institute of Arthritis, Diabetes, and Digestive and Kidney Diseases
NINCDS -	National Institute of Neurological and Communicative Disorders and Stroke
NIAID -	National Institute of Allergy and Infectious Diseases
NIGMS -	National Institute of General Medical Sciences
NICHD -	National Institute of Child Health and Human Development
NEI -	National Eye Institute
NIEHS -	National Institute of Environmental Health Sciences
NIA -	National Institute on Aging
DRR -	Division of Research Resources

The membership of the NCC consists of representatives from the 11 Institutes and the Division that support nutrition research. Additional NIH offices, other agencies of the Public Health Service and the Department of Health and Human Services, and the Office of Science and Technology Policy in the Executive Office of the President have liaison representatives to the committee. The Nutrition Coordinating Committee (NCC) operates out of the Office of the Director, NIH.

The NIH nutrition program includes extramural and intramural research and research training, and research manpower development. The major component of the NIH nutrition program is the extramural research program carried out at various universities; in graduate science departments, principally departments of nutrition; and in medical, dental, and other health professional schools, especially schools of public health. The

NIH intramural program in nutrition research is carried out on the NIH campus in Bethesda, Maryland, primarily at the Clinical Center, with the exception of the programs of two Institutes: The intramural program of the National Institute on Aging is carried out at the Gerontology Research Center in Baltimore, Maryland, while that of the National Institute of Environmental Health Sciences is located in Research Triangle Park, North Carolina.

Nutrition is an important, crosscutting program area within the NIH. For this reason, the nutrition program is coordinated through the NIH Nutrition Coordinating Committee that operates out of the Office of the Director and is advisory to the Director. The mandate of the Nutrition Coordinating Committee is to review, stimulate, and encourage the necessary support of nutrition research and training in order to better define the role of nutrition in the promotion of health, and the prevention and treatment of disease. As one of the committees that oversees selected "trans-NIH health problems," the Nutrition Coordinating Committee meets annually (or as required) with the Director, NIH, to review progress and plans in nutrition research.

The committee is the focus for the review of nutrition research and training priorities, their coordination, and for the development of the NIH Program in Biomedical and Behavioral Nutrition Research and Training. This focus minimizes duplication of effort among the Institutes and identifies areas where research, research training, and research manpower development in nutrition need to be advanced. This is accomplished through joint program announcements (PA's) and requests for applications (RFA's) developed by the Committee and sponsored by more than one Institute. Committee representatives are also encouraged to have their individual Institutes develop program announcements, requests for applications, and requests for proposals (RFP's).

The committee plays a key role in the development of nutrition policy at the NIH. Currently, nutrition policy at the NIH emphasizes eight critical areas. Research is emphasized in four of these critical areas: Clinical Nutrition Throughout The Life Cycle; The Role of Nutrition in Disease Development; Prevention of Disease; and Treatment of Disease. The other four critical areas are the Transfer of Modern Nutrition Technology, Nutrition Education for Professionals and The Public, Nutrition Research Training and Research Manpower Development in Nutrition, and the Coordination of all these activities. Each year, the NCC prepares the Annual Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training for the preceding fiscal year and sponsors a major conference or workshop in nutrition that includes the interests of many Institutes. The proceedings of this conference are published. In addition to coordinating the NIH nutrition program, the NCC office staff is also assigned additional responsibilities that include responding to requests for information on nutrition from Congress and from other Federal agencies. During FY 1981, the NCC office continued to serve as the executive secretariat for the Joint Subcommittee on Human Nutrition Research (JSHNR) that is cochaired by Dr. D. Mark Hegsted, representing USDA, and by Dr. Artemis P. Simopoulos, representing DHHS.

The Chairman of the Nutrition Coordinating Committee has been designated by the Secretary, Health and Human Services (DHHS), as the "initiative coordinator" for the Health Research Initiative on Nutrition Research. The purpose of the Nutrition Research Initiative is to develop a cohesive program for DHHS in nutrition research and training so that the precise role of nutrition in health and disease can be defined and that appropriate mechanisms emerge for the prevention and proper management of disease. The health research initiatives are experiments in cooperative research, planning, and implementation by DHHS agencies and represent efforts to strengthen research through cooperative planning and information exchange on a continuing basis.

As in previous years, the Institutes continued to emphasize the nutrition research program through the publication in the NIH Guide for Grants and Contracts of seven program announcements, four requests for applications and seven requests for proposals.

Part I of the report presents the FY 1981 Program in Biomedical and Behavioral Nutrition Research and Training in two sections. The first section begins with the definition of nutrition research at the NIH, and then focuses on the FY 1981 obligations for nutrition research and training. The analysis of the fiscal aspects of the program include an overview of the nutrition program and a comparison of actual obligations for nutrition with NIH obligations as a whole.

The second section consists of narrative descriptions beginning with a brief description of the Clinical Nutrition Research Units and a summary of their first annual meeting, which was held in FY 1981. Descriptions of the extramural and intramural research programs, and the nutrition research training program follow. Expanded descriptions of "Highlights of the Special Interest Areas in Nutrition" emphasize research of particular scientific interest. The 15 special interest areas are: Nutrition and Prevention of Disease, Nutritional Status, Behavioral Studies in Nutrition, Child and Infant Nutrition, Research on Vitamins, Epidemiological Research in Nutrition, Nutrition and Obesity, Nutrition and Genetics, Total Parenteral and Enteral Nutrition, Nutrition and Aging, Maternal Nutrition, International Research in Nutrition, Nutrition Education for Professionals, Nutrition Education for the Public, and Nutrition Education Research.

Part II of the report describes the structure of the NIH Nutrition Coordinating Committee, the charge of the Subcommittee on Nutrition Education, and highlights of the committee's and subcommittee's activities and accomplishments in FY 1981.

Part III describes the major responsibilities and activities of the NCC office. These activities encompass: responding to information requests about nutrition in general and about the NIH nutrition program in particular from the Congress, other Federal agencies, the scientific community and the public; collaborating in the Clinical Center Intramural Research Study on the Long-Term Effect on Infants of Hypochloremic Metabolic Alkalosis Resulting from Infant Formulas Deficient in Chloride; coordinating the Departmental Research Initiative in Nutrition; participating in the activities of the DHHS Nutrition Coordinating Committee and its Subcommittee on Nutrition Research and Research Training; representing NIH in various nutrition activities under way at the Office of the Assistant Secretary for Health (OASH); and serving as the Executive Secretariat of the Joint Subcommittee on Human Nutrition Research (JSHNR) of the Committee on Health and Medicine (CHM) and the Committee on Food, Agriculture, and Forestry Research (CFAFR) of the Federal Coordinating Council for Science, Engineering and Technology (FCCSET), Office of Science and Technology Policy (OSTP) in the Executive Office of the President.

Part IV consists of five appendices: appendix A includes the nutrition policy of the NIH; appendix B presents the mandate of the Nutrition Coordinating Committee; appendix C presents the FY 1981 nutrition expenditures of the Institutes and DRR by support mechanism; appendix D presents the FY 1983 priorities in nutrition research and training by Institute and DRR; and appendix E includes the legislative authority of NIH for human nutrition research.

Over the past 5 years the NIH has expanded its nutrition research support in many areas. This came about through a series of program announcements, requests for applications, and requests for proposals. In fact, since 1977 the Institutes and the NCC have developed a total of 20 PA's, 9 RFA's, and 23 RFP's. The enthusiastic support of the scientific community, indicated by their response to this series of announcements and requests, can be clearly seen in the highlights of the special interest areas decribed in part I of this report. A major accomplishment of the NCC was the development of the concept of the Clinical Nutrition Research Unit (CNRU), that has led to the establishment of the new National Program in Clinical Nutrition and to shared facilities and resources among many investigatiors.

It is very encouraging that industry has joined Government in supporting centers in clinical nutrition, as well as providing fellowships, awards, and support for nutrition education for professionals and the public. In 1977, when the first Annual Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training was published by the NIH-NCC, it was stated that "nutrition research is on a sound scientific base." As we look ahead to this decade we can say that nutrition research has come of age, and has found its place in the pantheon of medical sciences.

Artemis P. Simopoulos M.D.

Artemis P. Simopoulos, M.D.
Chairman,
Nutrition Coordinating Committee
Office of the Director, NIH

I.

THE FY 1981 PROGRAM IN BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING

The Program in Biomedical and Behavioral Nutrition Research and Training is based on a common definition of nutrition research and a computerized data retrieval system developed by the Nutrition Coordinating Committee. The expansion of the program is the result of a number of requests for applications, requests for proposals and various program announcements developed by the Institutes themselves or jointly with the Nutrition Coordinating Committee. The program is presented in terms of the financial obligations in nutrition by category of support. The description of the program includes 15 special interest areas that were selected on the basis of scientific progress and political interest.

The NIH nutrition program is supported by the 11 Institutes and the Division of Research Resources (DRR) and is coordinated through the Nutrition Coordinating Committee. The program supports research and research training in nutrition as it relates to health maintenance, human development throughout the life cycle, disease prevention, and disease treatment.

DEFINITION OF NUTRITION RESEARCH AT THE NIH

Included in the first Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training, FY 1977 issued by the NCC was the definition of biomedical and behavioral nutrition research that the NCC developed. That definition, which continues to serve as a basis for data retrieval and for the assessment of information about the nutrition research and training activities of the NIH, is as follows:

> "The term nutrition research includes studies designed to assess the consequences of food or nutrient intake and utilization in the intact organism, including man, and the metabolic and behavioral mechanisms involved. These studies encompass investigation of nutrient variables at the cellular or subcellular level. This definition also includes:
>
> - Research designed to elucidate the metabolic role or function of nutrients in both animal models and man.
> - All studies concerned with genetic-nutrient-environmental interactions where a nutrient is a variable.
> - Dietary studies expected to produce significant changes in health status, including the maintenance of health and the treatment of disease in man. Such studies might include clinical trials, epidemiological studies, metabolic studies, surveillance, and nutritional status monitoring studies."

FY 1981 OBLIGATIONS FOR NUTRITION RESEARCH AND TRAINING

Overview of the Nutrition Program

For FY 1981, the total NIH actual obligation in biomedical and behavioral nutrition research and training was $148,501,000. This nutrition budget is summarized in table I by category of support. Actual obligations in nutrition by each Institute and applicable Division are as follows:

NCI	$ 30,313,000	NIGMS	$ 2,503,000
NHLBI	35,213,000	NICHD	20,108,000
NIDR	1,503,000	NEI	4,265,000
NIADDK	30,906,000	NIEHS	2,106,000
NINCDS	1,559,000	NIA	4,133,000
NIAID	1,562,000	DRR	14,330,000

TABLE I

National Institutes of Health
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981, BY CATEGORY OF SUPPORT
(Actual Obligations, in thousands of dollars)

	Item	Number	Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	1,189	$ 70,245		
	Clinical trials . .	113	3,206		
	Total			1,302	$ 73,451
Program projects:	Regular	74	15,190		
	Clinical trials . .	5	769		
	Total			79	15,959
Contracts:	Regular	113	7,870		
	Clinical trials . .	58	8,555		
	Total			171	16,425
Centers:	Regular	92	12,034		
	Clinical trials . .	1	33		
	Total			93	12,067
General research support				260	13,136
Reimbursement agreements				16	1,319
Training:	Training grants . .	268*	3,159		
	Fellowships	36	549		
	Total			304*	3,708
Research Career Development Awards				34	982
New, Academic and Teacher Investigator Awards				64	1,560
Subtotal - Extramural					$ 138,608
Intramural					
Projects				95	9,193
Training				25*	700
Subtotal - Intramural					$ 9,893
TOTAL NUTRITION RESEARCH AND TRAINING - NIH					$ 148,501

* Number of persons (preliminary data).

The FY 1981 actual obligations for nutrition of each Institute and DRR, by category of support are contained in appendix C (tables C-1 through C-12).

To determine obligations for nutrition research and training, the Institutes' program staff reviews all research grants and contracts in order to identify the portion of the project with a nutrition component, in accordance with the definition of nutrition research, and then determines the percentage applicable to nutrition. The NIH has thus been able to eliminate such confusing and easily misunderstood terms as "primary/secondary," "major/minor," "nutrition related," and "direct/indirect" in referring to its nutrition program. The NCC office has developed a computerized data retrieval system for the storage and analyses of data on nutrition research and training activities of the NIH. The data base is updated periodically and cross-checked against the NIH grant information and accounting system, IMPAC (Information for Management Planning, Analyses, and Coordination). This computer system has enabled the NCC office to carry out detailed analyses in terms of percentage of the nutrition component, support mechanism (contract, type of grant, etc.), and special interest area. Other analyses are performed on an ad hoc basis. The actual obligations for extramural research, training, and manpower development account for $138,608,000 while intramural research and training account for $9,893,000.

The extramural program is classified by mechanism of support into regular research grants, program projects, contracts, and centers. Clinical trials are funded by all four of these mechanisms. General research support, reimbursement agreements, training (training grants and fellowships), research career development awards, and new, academic and teacher investigator awards are also included in the extramural program. The intramural program consists of research projects and training (fellowships).

Research grants support a discrete, specified, circumscribed project to be performed by investigator(s) in areas representing specific interests and competencies. Such research is initiated entirely by investigators outside the NIH. In FY 1981, the NIH supported 1,302 research grants with nutrition components for a total obligation of $73,451,000. This category constitutes the largest single area of support in nutrition.

Program projects are also investigator initiated research, but differ from research grants in that they are awarded for the support of a broadly based, multidisciplinary, often long-term research program that has a specific major objective or a basic theme. A program project generally involves the organized efforts of relatively large groups, members of which are conducting research projects designed to elucidate various aspects or components of the major objective. In FY 1981, 79 program projects were funded for $15,959,000.

Contracts are initiated by the agency to develop or apply new knowledge or to test, screen, or evaluate a product, material, device, or component for use by the scientific community. In FY 1981, NIH funded 171 contracts with nutrition research components for $16,425,000.

Centers are an additional component of agency initiated research, and they support any part of a full range of research and development from very basic to clinical. Centers may involve ancillary supportive activities, such as protracted patient care, necessary to the primary research effort. The spectrum of activities comprises a multidisciplinary approach to a specific disease entity or biomedical problem area. In FY 1981, NIH obligations for the 93 centers with a nutrition research component were $12,067,000.

Investigator initiated research in FY 1981 amounted to $89,410,000, whereas agency initiated research support in nutrition was $28,492,000. Thus direct support for nutrition research was predominantly investigator initiated. The $89.4 million obligated for investigator initiated nutrition research in FY 1981 was 60 percent of all nutrition research and training obligations in that fiscal year. Obligations for agency initiated research (contracts and centers combined) were $28,492,000, or 12 percent of total FY 1981 obligations for nutrition research and training.

Clinical trials in nutrition are supported by each of the four major mechanisms discussed above--research grants, program projects, contracts, and centers. A clinical trial is defined as a scientific research activity undertaken to define, prospectively, the effect and value of prophylactic/diagnostic/therapeutic agents, devices, regimens, procedures, etc., applied to human subjects. The study must be prospective, and intervention of some sort must occur. The number of cases or patients depends on the hypothesis being tested, but must be sufficient to permit anticipation of a definite, statistically significant, result. Phase I, feasibility, or pilot studies are excluded by definition.

FY 1981 obligations in support of 177 clinical trials with nutrition components totaled $12,563,000. These obligations constitute 8.5 percent of total nutrition obligations for FY 1981. The distribution of clinical trials among the four support mechanisms is displayed in table II.

TABLE II

SUPPORT MECHANISMS FOR CLINICAL TRIALS, FY 1981
(dollars in thousands)

Funding Mechanism	Number of Clinical Trials	FY 1981 Expenditures
Research Grants	113	3,206
Program Projects	5	769
Contracts	58	8,555
Centers	1	33
TOTAL	177	12,563

General research support is provided almost entirely by the Division of Research Resources. For FY 1981, a total of $13,126,000 was devoted to this category of the NIH nutrition program. The DRR provides general research support through five mechanisms:

1. The General Clinical Research Centers Program, with nutrition obligations of $11,163,00 in FY 1981, constitutes the bulk of DRR general research support. These centers foster the development of technological and therapeutic advances to expedite the application of basic biological knowledge into effective patient care.

The balance of $1,963,000 is provided through the following four mechanisms:

2. The Animal Resources Program provides a unique institutional research environment for the use of nonhuman primates or other animals in multicategorical research.

3. The Biomedical Research Support Program responds to emerging research opportunities and allows the supported institution self-determination in the development and conduct of pilot and other small projects.

4. The Biotechnology Resources Program attempts to interface the knowledge of the physical sciences, mathematics, and engineering with biology and medicine.

5. The Minority Biomedical Support Program provides funds to ethnic minority institutions to conduct research.

Reimbursement agreements are entered into between the NIH and other Federal agencies. In FY 1981, 16 such agreements were made in the area of nutrition by four Institutes, with total obligations of $1,319,000. The 16 reimbursement agreements are listed in table III.

Training in biomedical and behavioral research is supported by NIH through national research service awards. Eight Institutes support extramural training grants in nutrition research awarded to institutions for the support of training of individuals selected by the institutions, while seven Institutes awarded fellowships in nutrition research to individual applicants. A total of 304 extramural trainees and fellows were supported for a total of $3,708,000. (See also table VII.)

Manpower development in nutrition research is furthered through research career development awards and through new, academic, and teacher investigator awards. In FY 1981, eight Institutes supported 98 individuals at a total cost of $2,542,000 by these mechanisms.

Intramural research and training was carried out by eight Institutes with a total obligation of $9,893,000, of which $700,000 was devoted to training (fellowships) by three Institutes.

TABLE III

INTERAGENCY REIMBURSEMENT AGREEMENTS WITH NUTRITION RESEARCH COMPONENTS FUNDED BY NIH IN FY 1981

NCI	- Followup of the National Health and Nutrition Examination Survey (with National Center for Health Statistics)
	- In Vitro Transformation of Epidermal Cells (with Department of Energy at Oak Ridge National Laboratory)
	- In Vitro Quantification of Nitrogen by Whole Body Neutron Action (with Department of Energy at Brookhaven National Laboratory)
	- Chemoprevention of Epithelial Cancer by Retinoids (with Department of Energy at Brookhaven National Laboratory)
	- Diet and Nutrition, Genetically Distinct Animals, and Carcinogenesis (with National Center for Toxicological Research)
	- Research on Occupational Carcinogenesis (with National Institute of Occupational Safety and Health)
	- Epidemiological Studies of Cancer in Alaskan Natives (with CDC)
NHLBI	- Analyze Human Serum Samples on Diet Study & Metabolism (with Department of Energy, Germantown)
	- CDC-NHLBI HDLC Standardization Program (with CDC)
	- Technical Resources for Basic Analytical Techniques (with CDC)
	- Food Fatty Acid Analysis and Evaluation (with U.S. Department of Agriculture)
	- Services and Resources Provided by CDC for NHLBI (with CDC)
	- Lipid Research Clinics Program (with CDC)
	- Data on Nutrient Content of Foods in American Diet (with U.S. Department of Agriculture)
NIA	- Followup Study of U.S. Health and Nutrition Examination Survey (HANES) Respondents (with NCHS)
NICHD	- Followup on the 1980 National Natality and Fetal Mortality Survey (with NCHS)

Figure 1 presents an overview of these data, displaying each Institute's and DRR's obligations in nutrition research and training. In this figure, the total obligation of each Institute is divided into five components. The three lowermost components of each bar, taken together, represent each Institute's total obligation for extramural nutrition research. These three components represent: those grants and contracts with a nutrition component less than 50 percent of the entire grant or contract; those with a nutrition component of 50-99 percent; and those that are entirely (100 percent) nutrition research. The other two components depicted in each bar represent: 1) training grants and fellowships and 2) intramural research (the top component of each bar).

FY 1981 EXPENDITURES OF NIH PROGRAM
IN BIOMEDICAL AND BEHAVIORAL NUTRITION
RESEARCH AND TRAINING, BY B/I/D

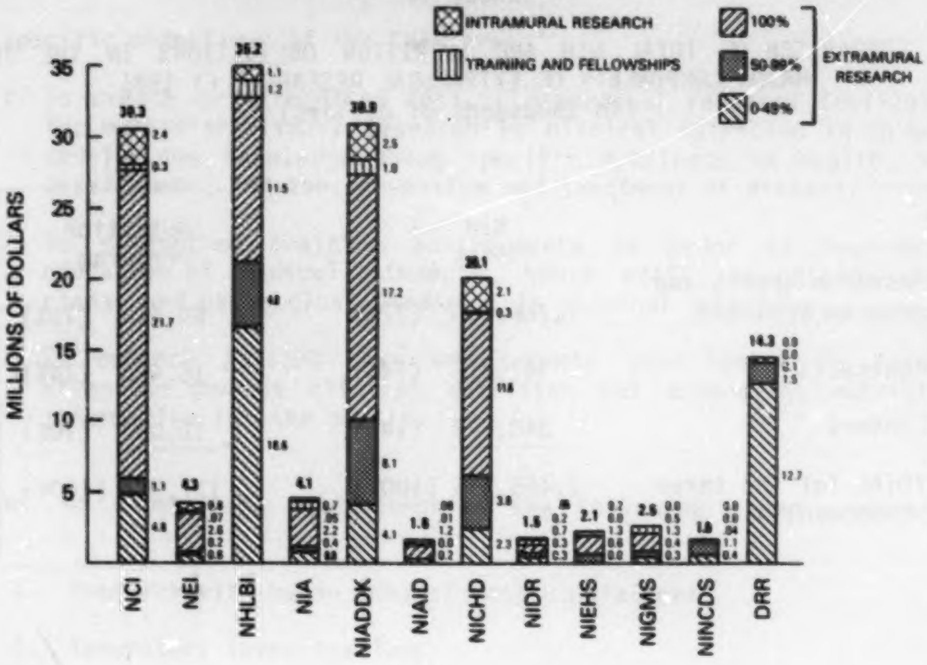

Figure 1

Comparison of Nutrition Program With Overall NIH Program

The entire NIH appropriation for FY 1981 was $3,249,475,000; in comparison, the nutrition obligation of $148,501,000 is 4.5 percent of the total NIH budget. The nutrition component of NIH research grants and program projects was 5.0 percent, of contracts 4.7 percent, and of centers 3.5 percent. As can be seen from table IV, research grants and program projects (investigator initiated research) account for 72 percent of the NIH extramural research component and 76 percent of the nutrition budget. This indicates that investigator initiated research is the predominant component of the research of both the agency and the nutrition program. Similarly, contracts represent 14 percent for both, and centers 14 percent for NIH as a whole and 10 percent for the nutrition program. This suggests that with respect to centers, the nutrition program lags behind NIH programs as a whole.

TABLE IV

COMPARISON OF TOTAL NIH AND NUTRITION OBLIGATIONS IN THE THREE MAJOR COMPONENTS OF EXTRAMURAL RESEARCH, FY 1981
(in thousands of dollars)

	NIH Total		Nutrition Program	
Research grants and program projects	1,766,640	(72%)	89,410	(76%)
Contracts	347,818	(14%)	16,425	(14%)
Centers	340,878	(14%)	12,067	(10%)
TOTAL (of the three components)	2,455,336	(100%)	117,902	(100%)

THE CLINICAL NUTRITION RESEARCH UNITS

Since 1979, the NIH has supported a new National Program in Clinical Nutrition Research based on Clinical Nutrition Research Units (CNRU). A CNRU is an integrated array of research, educational, and service activities that is oriented toward human nutrition in health and disease. These units are funded jointly by NIADDK (five units) and NCI (two units).

The NIH has traditionally sponsored the component activities of CNRU's through a variety of award mechanisms, the principal ones having been research project grants and support for research training. The present initiative, core grants for shared facilities, has become an invaluable addition, especially in promoting multidisciplinary interactions. This approach also tends to ensure that a given CNRU has multiple sponsors, both Federal and non-Federal, thereby reducing the likelihood that it will become unduly dependent upon any one source for its continuing operation. Funding for educational programs and nutritional support services (patient care) are generally sought from sources other than NIH.

The specific objectives of the CNRU are:

1. To create or strengthen foci in biomedical research institutions for multidisciplinary research in clinical nutrition in order to develop new knowledge about specific nutrients in health, human development, and the prevention and treatment of disease.

2. To strengthen training environments in order to improve the education of medical students, house staff, practicing physicians, and paramedical personnel in clinical nutrition.

3. To enhance patient care and promote good health by focusing attention towards clinical nutrition and generating nutritional information for the public.

A CNRU, at a minimum, must comprise the following seven components:

1. Research with human subjects and populations,
2. laboratory investigations,
3. research training,
4. shared facilities and research services,
5. education programs for medical students, house staff, practicing physicians, and paramedical personnel,
6. nutritional support services, and
7. public information activities.

The CNRU directors meet annually at the NIH with NIH staff. The purpose of the annual meeting is to facilitate communication, review research findings and problems, and discuss administrative concerns and constraints.

The first annual meeting of the CNRU directors was held December 3, 1980, at the NIH. The morning session was opened by the cochairpersons representing NCI and NIADDK and the NCC Chairman. Each CNRU director presented a progress report and outlined future plans for nutrition research and education activities. The reports included nutrition research with human subjects; laboratory investigations; research training; shared facilities and research services; education programs for medical students, house staff, practicing physicians, and paramedical personnel; nutritional support services; and public information activities. From the session it appeared that nutrition is a component of many research projects; courses on nutrition are being developed for use in the medical school curriculum; medical residents are being rotated through the nutrition service; the house staff is being exposed to formal and informal nutrition conferences, nutrition consultative services, and patient care activities related to nutrition; and nutrition education materials for the general public are being developed. Representatives from NCI, NHLBI, NIA, NIADDK, NIAID and NICHD presented reports on the needs and priorities in nutrition of their respective Institutes. The afternoon session consisted of discussions on "Information Exchange and Resource Sharing" and "Ways to Stimulate Research and Manpower Training in Clinical Nutrition."

THE EXTRAMURAL PROGRAM

The major component of the NIH nutrition program is the extramural research program carried out at various universities; in graduate science departments, principally departments of nutrition; and in medical, dental, and other health professional schools, especially schools of public health.

The Research Program

Nutrition research supported by NIH includes the effects of nutrients on human growth and development, health maintenance and promotion, disease prevention, and disease treatment. The primary nutrition mission of NIH lies in biomedical and behavioral research and training; however, NIH also funds nutrition education for professionals and the public as an integral part of many research programs. NIH provides the public with nutrition pamphlets, public service announcements on radio and television, and materials for magazine articles. Nutrition education for professionals is provided through various scientific publications, conferences, and workshops. Appendix E describes the Institutes' legislative authorities for nutrition research.

The role of nutrition in normal development and disease prevention during all stages of the life cycle--pregnancy, infancy, childhood, adolescence, and old age--is a major portion of the extramural research conducted by NICHD and NIA. NHLBI, NIDR, NIADDK, NINCDS, NIAID, NIGMS, NEI, and NIEHS also support research on the role of nutrients in health promotion and in human growth and development throughout the life cycle. DRR provides many of the resources needed to perform this research. NCI studies nutrition as it affects the onset and course of cancer, seeking thereby to discover clues to aid in the prevention and regression of disease.

Substantial research is attempting to identify the exact relationships between cancer and specific nutrients and additives. Projects in cancer cause, prevention, biology, diagnosis, and treatment take place in hospitals, research centers, and universities both within the United States and abroad.

The National Cancer Institute supports a number of research projects to elucidate the nature and mechanism of action of dietary substances with some evidence of anticarcinogenic properties. Vitamin A and its analogs, vitamins B_6, B_{12}, C, E, and folic acid are among those being investigated. In addition, some studies look at the relationship of dietary vitamin and mineral uptake to the development of cancer. The NCI also supports research on known and suspected carcinogens in the food cycle. Studies range from a general analysis of dietary carcinogens to specific metabolic studies of N-nitrosamines and saccharine.

Major investigative efforts attempt to determine whether dietary components and environmental factors serve as risk factors in the etiology of various site specific cancers. Tumor registry data are also being used to address a possible relationship between nutritional factors and cancer incidence and control. Case control studies focus on the relationship of dietary fiber, fat, vitamins, drinking of various types of alcohols, and smoking to colon, other gastrointestinal, and skin cancers.

In the area of genetics, NCI is exploring the possibility that analysis of human cells can be used to test and predict cancer risk. Such research involves in vivo and in vitro observations of aflatoxin metabolism, manipulation of amino acids, and new methods to discriminate gene carriers from nongene carriers. Recognition of markers specific to a cancer-prone genotype may have important implications for identification of high risk patients in the general asymptomatic population. The NCI is also interested in the evaluation of nutritional support procedures and related social and behavioral changes as they apply to the prevention or treatment of anorexia, malnutrition, and cachexia in cancer patients. Development of tools for nutritional assessment of patient populations will provide scientists with more sophisticated means for measuring nutrients and body components.

The National Heart, Lung, and Blood Institute supports major nutrition research projects in the program areas of hypertension and coronary heart disease. For hypertension these projects focus on the control of high blood pressure through education intervention projects utilizing existing resources in the work place and community. Some projects focus on rural or minority populations. Also, dietary intervention studies are being funded to determine the success of controlling blood pressure by nonpharmacologic means. A basic research project is assessing changes in peripheral vascular resistance in response to dietary sodium. Other investigators are receiving support to develop quantitative methodology for the estimation of sodium intake via the measurement of sodium excretion.

In the program area of coronary heart disease, the clinical trials of MRFIT and the Lipid Research Clinic Coronary Primary Prevention Trial both include nutrition intervention components. In addition there are several nutrition intervention research projects both in public school systems and in community wide health education programs for reducing cardiovascular risks. Research support is being provided to implement workshops for nutrition counseling in hyperlipidemia and to evaluate the effect of these workshops on the skills and practices of nutritionists.

Basic research continues in studies of dietary influence on the metabolism, structure, composition and blood levels of lipids and lipoproteins.

The National Institute of Dental Research supports research on the relationship between diet and nutrition, and the development and maintenance of both hard and soft tissues of the oral-facial complex. Special interests are in the problems of tooth and gingiva development and maintenance, periodontal disease, and dental caries. The NIDR's National Caries Program focuses on the development of a measure of the cariogenicity of various foods and on the development of various sugar substitutes. The use of fluorides in preventing dental caries has been established, and NIDR continues to study the metabolic and developmental effects of various fluoride levels in humans as well as the mechanism by which fluoride induces caries resistance.

The National Institute of Arthritis, Diabetes, and Digestive and Kidney Diseases supports extramural research and training in basic and clinical nutrition, especially in those areas where additional emphasis is needed to achieve the goal of improved health and longevity. Much of the research might be described as basic in nature, directed toward development of new knowledge about the role of nutrients in human physiology and biochemistry. Generally, such research has been nutrient centered rather than organ centered or focused on a specific disease. Discoveries from basic research have advanced our understanding of the function of nutrients in the whole body and have found wide application in clinical medicine. An example is the discovery that dietary vitamin D must be converted to a modified form to be active, and that kidney tissue is required for one step in the conversion. This has led to impressive new clinical applications, especially in bone and kidney diseases.

The widespread prevalence of nutrition related diseases or conditions such as atherosclerosis, diabetes, obesity, osteoporosis, alcoholism, and anemia in certain segments of the population is evidence of the need for a better understanding of the nutritional aspects of these clinical problems. The greatest promise for solutions to these problems lies in fundamental studies, such as those on absorption, metabolism, mechanism of action of nutritional factors, and the role of diet as a metabolic regulator. Recent technological advances, including mass spectrometry, high pressure liquid chromotography, and radioimmunoassay, should permit rapid progress in basic nutrient centered biomedical studies.

The NIADDK nutrition program supports basic studies on the metabolism of protein, amino acids, vitamins, minerals, fatty acids, dietary energy sources, and dietary fiber; research on obesity with the aim of prevention and control; human nutritional requirements and factors influencing them; interaction of nutrients and drugs; the role of nutrition in infection and immune competence; and nutritional status assessment and nutritional support of patients. Nutrition also constitutes a significant component of research supported by other NIADDK programs, especially digestive diseases, diabetes, metabolism, hematology, endocrinology, kidney, and liver diseases programs. NIADDK continues to have a primary responsibility for training in nutrition through fellowships and training grants.

The National Institute of Neurological and Communicative Disorders and Stroke nutrition research program covers nutrition and genetics, behavioral studies, obesity, nutritional status, child and infant nutrition, maternal nutrition, and vitamins. Most studies involve animals. In the clinical studies, the focus is on neurological disorders.

In order to clarify the two-way interaction between nutrient intake and central nervous system activity, scientists investigate the neural control of ingestive and drinking behavior, the effect on appetite of the interaction between gustatory sense and olfaction, the influence of nutrients on the onset or progress of neurological disorders, and the metabolic effect of nutrients on inborn errors of metabolism that cause neurological impairment. Also under study are the effects of protein and vitamin deprivation on central nervous system metabolism and on fetal development, the mechanism of transport of nutrients and their metabolic products across blood-brain and blood-cerebrospinal fluid barriers, the effect of vitamins on intake and utilization of nutrients, the relation between central nervous system and body weight, and the effect of nutrients and of central nervous system metabolites on peripheral nerve metabolism in health and in diabetes.

The National Institute of Allergy and Infectious Diseases promotes and supports research in the broad field of nutrition, infection, and immunity. Specifically, NIAID interests focus on the modulating effect of specific nutrients on immune function, mechanisms of food allergies and immune response to ingested antigens, interaction of nutrition and infection in tropical environments and in American hospitals, and modulating effect of specific nutrients on microbial virulence.

The National Institute of General Medical Sciences supports research directed to the discovery of better ways to prevent death from injury, mitigate pain, speed recovery of patients, and lessen the extent of disabilities caused by injuries. A better understanding is sought of the total body response to trauma, including burns. Studies include the biochemical and physiological changes induced by trauma, and the fundamental aspects of wound healing and biological repair. Emphasis is also given to research on the treatment of post-traumatic infections, nutritional requirements of burn victims, and rehabilitation of injured patients. The NIGMS trauma and burn program supports research related to nutrition in the following areas: nutritional aspects of severe trauma and sepsis, new concepts in parenteral protein sparing therapy, branched chain amino acid feeding during injury, and cellular response in shock.

The National Institute of Child Health and Human Development extramural research program focuses on the continuum of human development, from conception through infancy, childhood, and adolescence. The program emphasizes preventive approaches to nutrition related conditions, and stresses health promotion as well as disease prevention. Much of the research is multidisciplinary in nature and involves genetic, biochemical, developmental, anthropometric, behavioral, and cultural aspects of nutrition.

The NICHD has a strong interest in the area of infant nutrition and in elucidating the roles played by diet in infant development. Research interests focus on the nutrient requirements of normal, premature, and growth retarded infants, as well as on analyses of human milk, cow's milk and synthetic formulas in relation to optimal infant nutrition. In some of this work, the interest centers on metabolic processes in neonatal adaptation, and on the role played by essential nutrients in enhancing early development. A major contract is designed to develop human milk banking technologies for collection, storage, processing, and distribution of human milk and colostrum; the goal is to discover ways to preserve the labile nutritional and immunological components of these complex fluids during processing and storage.

Studies in nutrition and child development emphasize nutrition as a potentiating factor in cerebral and somatic development. Improved fetal nutrition is the major goal of the maternal-fetal nutrition effort.

Through an Interagency Reimbursement Agreement, NICHD provides partial support to the National Center for Health Statistics for the 1980 National Natality Survey (NNS) and National Fetal Mortality Survey (NFMS). The National Natality Follow-Back Survey of the NNS is a mailed survey of mothers, physicians, and hospitals for a 1 in 500 sample of legitimate births in the U.S. during calendar year 1980. The NFMS is a similar survey of a 1 in 4 sample of all stillbirths over 20 weeks gestation. As part of these surveys, questions are asked concerning breast-feeding and the health of the mother and infant. Pretests involving over 5,000 mailings and 4,000 telephone attempts at telephone contact were used to develop the final questionaires.

Research on dietary therapy of inborn errors of metabolism looks at abnormal metabolism of nutrient substrates. Included are investigations of the biochemistry and genetics of inborn errors which are, or may prove to be, treatable with diet. Many inborn errors of metabolism cause mental retardation or other disabilities of the central nervous system. Clinical research has shown that some of these diseases are amenable to nutritional management, as are a number of inherited metabolic diseases not associated with mental subnormality, such as lactase deficiency, cystic fibrosis, and some hereditary anemias. In most inborn errors of metabolism the mechanisms, by which aberrant levels of metabolic intermediates interfere with cerebral function, remain unknown; neurochemical research in animal models, e.g., experimental phenylketonuria and galactosemia, is being supported to answer this central question.

Most studies on nutritional aspects of developmental gastroenterology consist of basic research on cellular differentiation in relation to the functional development of the gastrointestinal tract. Studies are also progressing on digestive and absorptive disorders, particularly intractable diarrhea, in human infants.

Research on cultural and behavioral determinants of nutritional individuality includes studies of habits, taste and olfaction; food avoidances; behavior modification of dietary intakes; and projects on children's conceptualization of food and on the influence of television commercials on children's food preferences. Research on nutritional antecedents of adult disease focuses primarily on factors in the development of obesity in infancy, childhood, and adolescence. Other NICHD research emphasizes the development of new methods for assessing nutritional status, particularly during infancy, adolescence, pregnancy, and lactation. Additionally, studies are exploring the involvement of vitamins and trace elements in sensitive reproductive processes (such as spermatogenesis), and the effects of oral contraceptives on the metabolism of folic acid, pyridoxine, and ascorbic acid. The reproductive consequences of low protein diets as reflected in gonadotropin production, fertility, and lactation are also under investigation. Other NICHD researchers are looking at the augmented nutrient demands caused by the growth spurt and the onset of puberty. A study of glucose and protein metabolism in obese adolescents is also under way.

The National Eye Institute supports research on the role of nutrition in normal ocular and visual development and function and on the relationship between nutritional deficiencies and eye and vision disorders. Malnutrition, particularly vitamin A deficiency, although not a major problem in the United States, is a leading cause of childhood blindness in developing countries in various parts of the world. National Eye Institute research grants support studies of the normal metabolism of ocular tissues, particularly the role of vitamin A and other nutrients in normal retinal and corneal function. The effects of experimental malnutrition on the eye with particular emphasis on deficiencies of proteins, amino acids, and certain vitamins are also being investigated. In particular, the identification of possible nutritional risk factors for the development of cataract is being pursued. Other studies are exploring the effect of individual nutrients on metabolic processes involved in immune responses in the visual system.

The past decade has seen a dramatic resurgence in the incidence of retrolental fibroplasia or retinopathy of prematurity. The National Eye Institute supported clinical trial is seeking to determine the safe levels of supplemental oxygen and to learn if vitamin E (D/L-alpha tocopherol) can reduce the incidence and severity of this malady. A research grant is studying retinol metabolism with special regard to the eye.

In spite of decades of research, the basic cellular function of vitamin A is still undefined. A study is being made of various proteins which function as retinol carriers. Complete or nearly complete sequences of both human and rabbit plasma retinol binding protein (pRBP) and rabbit intracellular retinol binding protein (cRPB) are now available. The release of pRPB from the liver is regulated by vitamin A levels and the mechanism of the regulation is being further studied. Zinc, present in high concentrations in tissues of the mammalian eye, is also being studied. The trace metal apparently has a variety of functions, including serving as an essential constituent of a zinc metalloenzyme, alcohol dehydrogenase. This enzyme is vital for the regeneration of rhodopsin.

Research supported by the National Institute of Environmental Health Sciences focuses on the interactions between environmental contaminants and the nutritional or dietary constituents of biological systems. Thus, for example, toxic agents are studied in fed or fasted animals to learn the pharmacokinetic and toxic effects of dietary balance or specific dietary elements as they interact with the pollutant. Other research investigates the effects of heavy metals intake on the metabolism and balance of essential elements. Conversely, the role of essential element level or supplementation is studied for its protective role against heavy metals, one example being the protective role of zinc against heavy metal toxicity in the liver. Selenium is of considerable interest because of the need to clarify the biologic functions of this essential and toxic nutrient and to explore its accumulation and transmittal through the food chain. Additional studies seek to determine toxic changes generated in the enterohepatic, biliary, and renal systems by environmental contaminants and the alteration of these systems to prevent biological insult through decreased absorption and enhanced secretion.

Another major segment of the NIEHS nutrition program comprises research in food toxicology. One group of grantees is studying the toxic effects and biologic mechanisms of natural toxicants in plant foods. Others are looking at contaminants resulting from food storage, such as the mycotoxins and furans, that are generated under suboptimal storage conditions. Food processing hazards such as nitrates and other additives are studied to learn how they are altered in the foodstuffs and how they are transformed by biological systems, and to explore their toxic properties and mechanisms.

The National Institute on Aging supports research on aging that includes both basic and clinical studies using a variety of experimental systems ranging from cellular systems to the whole organism. It has been known for many years that prolonged food restriction results in an increase in life span; however, the mechanism(s) responsible for this increase is not known. The NIA supports several studies in this area involving experimental systems ranging from cells in culture to the intact animals. Changes in RNA and protein synthesis are under study as well as changes in immune function and in the structure and function of several tissues, including adipose, hepatic, brain, muscular, skeletal, and vascular tissue.

Studies on the effects that various age related physiological changes may have on nutritional status focus on changes in renal physiology as they relate to the ability to handle salt and water; changes in intestinal physiology as they relate to absorption in general and to the role of vitamin D in calcium transport in particular; and changes in taste as they may affect food intake. Other research involves the role of specific dietary components in various age or disease related processes; e.g., the role of vitamin D metabolites in bone turnover and the effects of vitamin C on the pharmacokinetics of various substances in the elderly. The NIA also supports studies on dietary fat, specifically on high fat diets as these relate to formation of atheromatous lesions in mice, and on effects of level and composition of dietary fat on lipid metabolism with increasing age.

Also under investigation is the relationship between nutritional status and subsequent morbidity and mortality among the elderly. NIA supports a prospective study in which the dietary intake and tissue levels of a large number of nutrients are being determined periodically; these will be related to immune function and to morbidity and mortality. Another investigator is looking specifically at the role of protein malnutrition in the reduced immune function often seen in the elderly; an aim of this study is to determine which aspects of the altered host defense mechanisms are susceptible to aggressive nutritional therapy.

In addition, NIA is the lead agency in an interagency agreement with the National Center for Health Statistics for a followup of those HANES-I participants who were between the ages of 25 and 74 at the time of the original study. The followup is designed to relate data on individual characteristics and practices to subsequent health status, morbidity, and mortality. Of particular interest is the relation between various nutritional factors and subsequent health status.

Many of the basic resources needed to perform clinical nutrition research are provided by DRR. In FY 1981, DRR supported 75 General Clinical Research Centers in the U.S. The research beds, laboratories, professional nursing, and dietary personnel that comprise each center are essential to clinical investigation in nutrition. These centers conduct clinical nutrition studies on atherosclerosis, cancer, diabetes, environmental health factors, hyperlipidemias, obesity, parenteral nutrition, and vitamins. In all, the dietary support personnel working in these centers number 236 full time equivalent, while 800 interns are trained there annually. Several of the 43 currently funded, clinical associate physicians are directly involved in clinical nutrition research. The team approach in clinical investigation at the centers allows the basic scientist, clinician, dietitian, and nurse to interact in developing systematic methods for nutrition research. Research in nutrition is also enhanced by the four other DRR programs that serve health researchers throughout the country: Biotechnology Resources, Laboratory Animal Resources, Biomedical Research Support, and Minority Biomedical Support.

In summary, the Institutes with mandates in categorical diseases support nutrition research programs in their areas of responsibility in both the prevention and the treatment of disease; namely, NCI on diet and cancer; NHLBI on diet and heart, lung and blood disorders; NIDR on nutrition and dental caries; and NEI on nutrition and various eye disorders. NIADDK, NICHD, and NIA support nutrition research particularly related to nutrient requirements relevant to the different stages of the life cycle and specific metabolic and genetic diseases. Through studies in biochemistry, physiology, and cell biology, NIH supported research aims at elucidating fundamental mechanisms and at synthesizing the results into practical information on nutrition and diet that will assist the individual to develop normally, and to live as long and as healthy a life as possible.

Manpower Development

Manpower development in nutrition research is enhanced through research career development awards and through special research awards. The total obligation for these award programs was $2,542,000 for FY 1981.

Research career development awards (RCDA's) are awarded to further the career development of outstanding scientists with clear research potential or demonstrated capacity for independent research who require additional training and experience in a productive scientific environment to prepare for careers in independent research. In FY 1981, 34 RCDA's were awarded in nutrition by NCI, NEI, NHLBI, NIA, NIADDK, NICHD, NIDR and NIGMS for a total obligation of $982,000.

Several areas of research were under study by RCDA recipients. In nutrition and cancer, these included: the biosynthesis of mammalian glycoproteins, lipids and membrane structures of leukemia leukocytes, thymidine transport in normal and leukemia lymphocytes, asparagine biosynthesis in normal and tumor cells, hexosaminidase levels and diet, and human mucosal structure and function. In the area of cardiovascular diseases, research included: water metabolism in heart failure, sodium intake and hypertension, the cardiovascular and renal effects of potassium, the regulation of cholesterol metabolism in cultured cells, and the outcome of behavioral programs for chronic obstructive pulmonary disease and diabetes.

Metabolic studies included research on: metabolic and endocrine aspects of obesity, metabolic effects of diet and meal pattern, regulation of food intake and body fat, regulation of human gastric responses to meals, hypothalamic control of body weight and feeding, exercise and lipid metabolism, enzymatic control of vitamin D_3 endocrine complex, metabolic effects of burn injury and sepsis, protein nutrition in experimental uremia, glycerol-3-phosphate dehydrogenase and egg yolk avidin, trace mineral availability and metabolism studies, folate supply and utilization, and nutrition and drug metabolism in man. Studies on human development included research on: development and control of hepatic and renal gluconeogenesis, biochemical basis for experimental Fanconi syndrome, nutrition and development of adipose tissue, nutritional status of migrants in terms of age-associated health risks of obesity, diabetes and cardiovascular disease, longitudinal studies of primate sociobiology, maturation of neonatal carbohydrate homeostasis, chemical studies in growth and development, and maturational and adaptive changes in intestinal carbohydrate absorption in the postnatal period by noninvasive techniques of breath analysis. Other research included: the biochemistry of oral tissues, visual pigment and photoreceptor adaptation, characterization of neurotransmitters in the retina cone cell metabolism and visual transduction, and resonance raman microscopy of visual photoreceptors.

Special research awards (new investigator research awards, academic investigator awards and teacher investigator awards) are used also by the NIH as additional mechanisms for manpower development in nutrition.

In the past, special research award programs included the "new, young, and special investigator awards" that were issued to support basic and clinical studies so that newly trained investigators could remain active during the developmental stage of their careers. In FY 1980, the elements of all "new, young, and special investigator awards" were combined under the single title of "new investigator research award (NIRA)." The purpose of the NIRA is to encourage new investigators (including those who have interrupted early promising research careers) in basic or clinical science disciplines to develop their research activities within the program interests at NIH. This special grant-supported program provides research grant funds to help bridge the transition from training status to that of established investigator. The NCC developed a joint program announcement for a NIRA in nutrition in FY 1981.

"Academic investigator awards" create and encourage a stimulating approach to disease curricula that will attract high-quality students, foster academic career development of promising young teacher-investigators, develop and implement excellent multidisciplinary curricula through an interchange of ideas, and enable the grantee institution to strengthen its existing teaching program.

"Teacher investigator awards" provide the opportunity for promising medical scientists (with demonstrated aptitude to develop into independent investigators) or faculty members who will pursue research aspects of categorical areas applicable to the awarding unit, and aid in filling the important academic faculty gap in these shortage areas within health professional institutions of the country. The academic and teacher investigator awards are not used by all of the B/I/D's.

In FY 1981, 64 awards were made in these three categories for research manpower development in nutrition: 43 were R23 new investigator research awards for a total obligation of $1,232,000; 18 were K07 academic investigator awards totaling $219,000; and 3 were K08 teacher investigator awards totaling $109,000. The total obligation for these programs was $1,560,000.

The areas under study by the 64 recipients of these awards include fat metabolism and obesity, trace metals, hypertension and cardiovascular diseases, cancer, trauma, immune function, and eye disorders. Examples of studies in each of these areas are as follows:

- fat metabolism and obesity - effects of dietary intervention in obese rats, role of beta endorphin in obesity and feeding, effect of weight loss and exercise on lipoprotein lipase, polyunsaturated fatty acid metabolism in human cells, membrane integrity and cyclopropenoid fatty acids, sympathoadrenal regulation in experimental obesity, regulation of fat and protein synthesis, regulation of cholesterol esterification in the intestine, lipid esterification in liver and mammary gland, regulation of enzymes of triaglycerol metabolism, and phospholipid in plasma lipoproteins

- trace metals - the biochemical role of zinc in teeth and bones, the influence of dietary magnesium, influence of trace metals on dental health, neonatal gastrointestinal absorption of lead, mechanisms of chloride transport by rabbit colon, dietary sulfur and altered liver function

- hypertension and cardiovascular disease - neural control of renal tubular sodium reabsorption, coronary risk and psychology of dietary adherence, behavioral aspects of salt intake and hypertension, and to explore blood pressure levels and the role of common residence and network dynamics as a diagnostic unit

- cancer - dietary fats and antioxidants in mammary carcinogenesis and preventive oncology, relaxation training to reduce aversion to chemotherapy, lymphocyte carcinogen metabolism in acute leukemia, nitrate and nitrous oxide production by bacteria, and structure-toxicity relationships among heterocycles

- trauma - branched chain amino acid infusion in trauma, and hypermetabolism after severe head injury in children

- immune function - effects of retinoic acid on the immune system, functional properties of cellular elements in human breast milk, and the role of nutrition in the host defense mechanisms of the elderly

- eye disorders - binding proteins for retinoids in ocular tissues, pathological studies of ocular surface disorders, and photoreceptor transductions and retinal synapse formation.

Program Development

A major responsibility of the NCC is to identify areas for further research and bring them to the attention of the scientific community through the development and publication of program announcements, requests for applications, and requests for proposals.

A PA is a formal statement of an NIH extramural research activity or of the initiation of a new or modified mechanism of support. It may describe new or modified program interests, or simply be a reminder of continuing interest.

A RFA is a formal statement which (a) invites grant applications in a well-defined scientific area to accomplish specific program purposes, (b) generally identifies only one application receipt date, and (c) indicates whether or not funds have been set aside for the competition and, if so, the amount of funds and/or the expected number of awards to be made. A RFA may be reissued as necessary. PA's and RFA's often lead to the receipt and funding of many applications. For instance, 15 grant applications were received in response to the RFA on "Mechanisms in Food Allergy."

An RFP is the Government's invitation to prospective offerors to submit a contract proposal based on the terms and conditions set forth in the RFP by the statement of work that describes the nature of intended procurement. The number of contracts awarded as a result of an RFP is smaller. For example, three contracts were awarded in response to the RFP on "Human Milk Banking Studies."

Table V lists the 18 PA's, RFA's, and RFP's in nutrition published in FY 1981, with the origin and date of each announcement, the type of announcement, and its title. A brief description of each announcement follows the table. Included in the table are 7 PA's, 4 RFA's, and 7 RFP's. It is of interest that for the first time a joint PA, "NIH New Investigator Research Award (NIRA) in Nutrition--ADAMHA Special Notification for Research on Nutrition and Behavior," published in FY 1981, had the support of NIH (NCI, NIADDK, NICHD, and NIDR) and a sister agency, the Alcohol, Drug Abuse and Mental Health Administration (ADAMHA). The National Institute of Alcohol Abuse and Alcoholism (NIAAA) and the National Institute of Mental Health (NIMH) of ADAMHA joined NIH in encouraging new investigators to develop their research interests and capabilities in various aspects of nutrition and behavior.

TABLE V

PA's, RFA's, and RFP's in Nutrition Research and Training Published In The NIH Guide For Grants and Contracts, FY 1981

ISSUED BY	DATE	TYPE	TITLE
NICHD	1/9/81	RFP	Human Milk Banking Studies
NCI	1/26/81	RFP	Nutritional Assessment of Cancer Patients
NICHD	2/4/81	RFP	Fractionation, Identification and Characterization of Components of Colostrum and Human Milk
NCI	2/6/81	RFP	Calorimetry in Cancer Patients
NICHD	2/11/81	RFP	Clinical Studies on Human Milk
NIDR	3/6/81	RFA	National Research Service Awards for Institutional Postdoctoral Training Programs in Cariology

NIDR	3/16/81	RFP	Relationship of Dietary Intake to Caries Incidence
NHLBI	3/27/81	RFA	Demonstration and Education Research in Heart, Blood Vessel, Lung, Blood Diseases and Blood Resources
NCC (NIA, NIADDK, NCI, NICHD, NIDR, NIAAA, NIMH)	3/27/81	Joint PA	NIH New Investigator Research Award (NIRA) in Nutrition: ADAMHA Special Notification for Research on Nutrition and Behavior
NICHD	4/17/81	PA	Basic and Clinical Studies of Normal Development and Developmental Defects
NIADDK	4/17/81	PA	Research Interests of the Kidney Disease and Urology Program
NIDR	5/1/81	RFP	Identification of Cariogenic Elements of Foods
NCI	5/22/81	RFA	Mechanisms of Biological and Chemical Prevention of Carcinogenesis
NIAID	5/22/81	RFA	Mechanisms in Food Allergy
NHLBI	5/22/81	PA	Dietary Sodium and Its Role in the Prevention and Management of Hypertension
NIA	5/22/11	PA	Social and Behavioral Research on Aging
NIDR	9/4/81	PA	Diet and Nutrition Research
NIA	9/4/81	PA	Health and Effective Functioning in the Middle and Later Years

The RFP "Human Milk Banking Studies" issued by NICHD, requested studies on maternal variables that may influence the composition of colostrum and human milk. The variables to be considered include: 1) maternal nutritional status, diet and post partum weight changes (including food preferences and taboos); 2) infective agents; 3) drugs and medications; 4) environmental factors such as occupational exposures; and 5) maternal behaviors such as infant feeding practices and patterns as well as maternal sociocultural factors. Studies that adapt existing methods and/or develop new methods for processing human milk are also sought. The emphasis of these studies is on procedures that assure the retention of the greatest degree of biological function of milk while rendering it safe for clinical use (both bacterial and viral contamination will be considered).

The RFP "Nutritional Assessment of Cancer Patients" issued by NCI, solicited proposals to conduct a detailed nutritional assessment of a cohort of cancer patients. The specific issues to be addressed include the study of perturbations of a variety of nutritional parameters in the patient with advancing cancer and whether the resulting deficiencies are correctable by existing methods of nutrition intervention. The selection of the cancer categories will be based on considerations of the frequency of weight loss as a systemic effect of cancer with respect to the length of the clinical history of the tumor. Tumor categories to be studied include metastatic breast carcinoma, and/or metastatic non-small cell carcinoma of the lung. A common core of assessment techniques will be employed in the evaluation of the patients, but a variety of additional techniques may be funded.

The RFP "Fractionation, Identification and Characterization of Components of Colostrum and Human Milk" issued by NICHD, solicited studies to expand the knowledge base on the range of components present in human milk and colostrum as well as to characterize the physical and functional properties of previously known and newly discovered components of these fluids. Research is encouraged in at least one of the following areas: protein fractions and amino acids; lipids and essential fatty acids; factors that stimulate growth and differentiation of organ systems of the infant; and cellular fractions and humoral immunologic factors.

The RFP "Calorimetry in Cancer Patients" issued by NCI, solicited proposals for calorimetry studies in cancer patients in order to obtain input into the design of studies that will insure the accurate and efficient evaluation of the nutritional aspects of advancing malignancy. Specific issues to be addressed include, but are not limited to: the resting caloric expenditure, the response to exercise, the response to eating, and the response to protein calorie malnutrition. The selection of cancer categories is based on considerations of the frequency of weight loss as a systemic effect of cancer in the absence of evidence of interference with gastrointestinal functions, tumor stage and the possibility of changing tumor status with treatment.

The RFP "Clinical Studies on Human Milk" issued by NICHD, solicited clinical studies on the use of colostrum, human milk, and fractions of human milk in the nutritional management of low birth weight infants. The nutritional management of the low birth weight infants, both born prematurely and small for gestational age, attempts to achieve an acceptable rate of growth, optimum development of the immature immunologic system, and normal cognitive, behavioral, and motor development. Studies are encouraged to consider the unique appropriateness of colostrum and human milk in clinically managing the low birth weight infant, as well as modifying these fluids to meet the growth requirements of the infants while enabling them to receive biologically important factors found only in human milk.

The RFA "National Research Service Awards for Institutional Postdoctoral Training Programs in Cariology" issued by NIDR, sought applications to develop methods to prevent and ultimately eliminate dental caries as a public health problem. Investigation of the diverse factors implicated in caries etiology and the development and evaluation of preventive methods necessitates participation by investigators that include organic and physical chemists, microbiologists, immunologists, pharmacologists, nutritionists, behavioral scientists, statisticians, epidemiologists, and dentists experienced in conducting clinical trials and demonstrations programs. Institutions must have the faculty, facilities, and ongoing basic and clinical caries research programs to provide trainees with in-depth exposure to all of the following component subdisciplines: dental and oral anatomy and physiology; microbial etiology of caries; dietary factors in caries etiology, host immunity and susceptibility factors; use of animal models in caries research; and epidemiological surveys and clinical trials of chemotherapeutic agents in caries research.

The RFP "Relationship of Dietary Intake to Caries Incidence" issued by NIDR, solicited proposals to conduct a prospective study on the relationship between dietary intake patterns and the development of dental caries in a general population of school age children residing in a nonfluoridated area. Multiple, short-term, dietary intake measurements of total daily sugar consumption, total daily calories in terms of protein, fat and carbohydrate, total daily sugar consumption between meals, and total daily frequency of eating or drinking will be collected from approximately 800 school children, ages 11-13 years.

The RFA "Demonstration and Education Research in Heart, Blood Vessel, Lung, and Blood Diseases and Blood Resources" issued by NHLBI, sought applications to help fulfill the congressional intent of Public Law 92-423 that the NHLBI establish centers "...for basic or clinical research into, training in and demonstrations of, advanced diagnostic, prevention, and treatment methods for heart, blood vessel, lung or blood diseases." These National Research and Demonstration Centers must include three essential elements: basic laboratory research, clinical investigation, and demonstration and education activities. The demonstration and education research programs are directed toward health care professionals, the community, or the general public and are staffed by scientists and physicians whose expertise may include, but is not limited to, medical disciplines, health education, epidemiology, biostatistics, and behavioral and social science. The research projects are related to the following NHLBI programs: heart and blood vessel diseases--risk factor or factors for coronary heart disease in children and/or adults including diabetes, overweight, lack of exercise, and nutrition as it affects the cardiovascular system, etc.; lung diseases and respiratory distress of the newborn, respiratory failure, etc.; and blood diseases and blood resources such as thromboembolic disorders, the hemophilias, etc.

The Joint PA "NIH New Investigator Research Award (NIRA) in Nutrition: ADAMHA Special Notification for Research on Nutrition and Behavior" issued jointly by NIH and ADAMHA, seeks to encourage new investigators in basic or clinical science disciplines to develop their research interests and capabilities in biomedical and behavioral research in order to help bridge the transition from training status to that of established investigator. The research interests of the NIH Institutes seeking applications are as follows: NIA in biomedical, social and behavioral research and research training in the areas of diet and nutrition (both basic and clinical) as these relate to the aging process and the problems and needs of the aged individual; NIADDK's Nutrition Program, Digestive Diseases Program, Hematology Program, and Diabetes, Endocrinology and Metabolism Programs in relevant nutrition research; NCI's Diet, Nutrition and Cancer Program in all areas of diet and nutrition as they may relate to cancer; NICHD in developmental aspects of nutrition, particularly in regard to reproduction, lactation, infancy, childhood and adolescence; NIDR in the relationship of nutrition to dental caries, periodontal disease, oral soft tissue disease, and craniofacial anomalies. The ADAMHA in the area of nutrition and behavior through its regular research grant programs and in specific areas of interest relevant to the National Institute of Alcohol Abuse and Alcoholism and the National Institute of Mental Health.

The PA "Basic and Clinical Studies of Normal Development and Developmental Defects" issued by NICHD, encourages applications for research on the causes of congenital birth defects, due either to gene mutations or chromosomal aberrations, or to diverse agents in the internal or external environment of the developing embryo, fetus, or child. Investigations are encouraged on normal and abnormal human development during the periods prior to conception through early maturity at the basic and/or clinical level utilizing knowledge and techniques employed in disciplines such as developmental genetics, developmental biology, teratology, and developmental immunology. Nutrition, environmental chemicals, drugs, infections, maternal metabolic imbalances, ionizing radiation, as well as multifactorial insults are among the nonhereditary insults of interest as possible causes or mechanisms that produce disruptions in normal human development prior to conception and through early childhood. Also of interest are studies on immune system development during periods of malnutrition, the immunological properties of breast milk, the mechanisms that pertain to the mother's experiences with infection, the transfer of protection to the infant through breast-feeding, the events following ingestion of milk in the infant's digestive tract, and possible hazardous effects of breast-feeding.

The PA "Research Interests of the Kidney Disease and Urology Program" issued by NIADDK, seeks applications for investigator initiated research applications and training by national research service awards, in both fundamental and clinical investigations of the mechanism and disease processes of the kidney and urinary tract. Research encouraged by the Urology Program includes studies on urolithiasis and related disorders of divalent ion metabolism (calcium, magnesium, and phosphorous) including diagnosis and treatment, physical chemistry, endocrinology, biochemistry, nutrition, transport mechanisms, calculi dissolution, and epidemiology. Also, the Chronic Renal Disease Program encourages studies on maintenance therapies for end stage kidney disease; i.e., hemodialysis, hemofiltration, peritoneal dialysis, continuous ambulatory peritoneal dialysis, as well as the role of diet in therapy, and the development and evaluation of treatments.

The RFP "Identification of Cariogenic Elements of Foods" issued by NIDR, sought proposals to examine the effect of snack foods on caries production, salivary function, and microbial implantation in an attempt to identify and classify those elements that contribute to the cariogenicity (if any) of commonly eaten snack items. Epidemiological and dietary intake studies clearly implicate the dietary intake and the ingestion frequency of fermentable carbohydrates as an important cause in dental caries. Due to the changing eating patterns and an increase in the frequency of snacking, particulary in children who are caries susceptible, the identification of those elements rendering foods cariogenic is desirable. Food variables that have been identified in the caries process are: fermentable sugar content, retention in mouth (stickiness), texture, effect on salivary function, and effect on oral flora.

The RFA "Mechanisms of Biological and Chemical Prevention of Carcinogenesis" issued by NCI, sought applications for studies on the mechanisms of the inhibition of carcinogenesis through the mechanisms of action of the following agents: (1) antioxidants, flavonoids, disulfiram and related compounds, nucleophiles, including cellular nucleophiles, such as glutathione and other physiological trapping agents, coumarins and other lactones; (2) vitamins, provitamins and other cofactors; (3) retinoids; (4) protease inhibitors; and (5) biological agents such as chalones, lymphokines/lymphotoxins and tumor necrosis factor. Both basic and applied studies on the mechanisms of biological and chemical prevention of carcinogenesis are to emphasize the mechanisms of anticarcinogenesis and chemoprophylaxis, as opposed to anticancer or chemotherapy. Antipromotion and/or antiprogression of carcinogenesis, as well as inhibition of initiation and fixation are components of the study.

The RFA "Mechanisms In Food Allergy" issued by NIAID, sought applications to elucidate the basic mechanisms associated with a variety of allergic and/or adverse reactions to food. Detailed examinations of a single allergen in causing various allergic manifestations will help to define the component responsible for causing clinical reactions and to assess the diagnostic methods needed to assess specific clinical reactions. Studies are also encouraged to describe and assess precisely which allergic disorders (i.e., asthma, rhinitis, eczema, etc.) can be ascribed to allergic and/or adverse reactions to one or more food substances.

The PA "Dietary Sodium and Its Role in the Prevention and Management of Hypertension" issued by NHLBI, encourages applications concerning a broad range of investigations including physiological, clinical, preventive, and therapeutic research regarding the role of dietary sodium in hypertension and the prevention of hypertension. Examples of needed research include studies of: the relationship between sodium and weight; the interrelationship of sodium and potassium; sodium sensitivity; salt appetite; and methods for determining sodium intake in humans. Investigations that take account of other dietary factors, caloric intake, and energy expenditure are also encouraged.

The PA "Social and Behavioral Research on Aging" issued by NIA, seeks applications in the following three broad, overlapping categories: 1) Older People in the Changing Society refers to research on age as a structural feature of society both in the population and the organization of social roles; 2) Psychological and Social Components of the Aging Process includes studies of constancy and change in social or psychological characteristics, behaviors, and environmental responses of individuals as they grow old. This category stresses the social and psychological components of aging in such concerns as nutrition, neurological and endocrine aging, and antecedents and consequences of health and health disorders generally (including social and psychological factors in the etiology of diabetes and senile dementia); and 3) Older People and Social Institutions refers to research on relations of aging individuals to the several social institutions within which they grow old, including studies of the age structure of particular institutions and how institutions can shape older people's lives and in turn be shaped by older people themselves.

The PA "Diet and Nutrition Research" issued by NIDR, seeks applications for studies to define the influence of diet and nutrition on the growth and development of oral facial structures or repair of lesions and prevention of diseases in these structures. The goals of this research are to understand the influence of diet and nutrition on the oral and para-oral structures during all stages of life, through studies that identify and characterize the metabolic roles of nutrients and dietary conditions necessary for optimum growth, development, and aging as well as function, maintenance and repair of oral facial structures; to understand the effect of diet and nutritional deficiencies, excesses, imbalances, and other related factors on the pathogenesis and systemic sequelae of oral diseases and anomalies; and to understand and use dietary and nutritional approaches in prevention and management of oral-facial diseases and conditions.

The PA "Health and Effective Functioning in the Middle and Later Years" issued by NIA, seeks applications for research designed to specify how psychosocial processes, interacting with biological processes, influence health and functioning in the middle and later years. One of the issues falling within this realm is that of nutrition, exercise, and sleep that includes research in the following areas: psychosocial factors influencing age related changes in food preferences, eating habits, and nutrition; cohort differences in nutrition and their consequences for health in the middle and later years of life; long-term and short-term effects on health and effective functioning of various types of exercise; psychosocial factors in etiology and therapies for age-related sleep disorders; and behavioral consequences of age-related sleep disorders.

Nutrition Conferences Sponsored by the NIH

Each year the NIH sponsors a number of conferences on a variety of nutrition topics that reflect the current interest of the Institutes in areas of program development for nutrition research and training. Such conferences also help to expedite transfer of nutrition technology to scientists and educators so as to assure the appropriate application of research in practice. Table VI lists the conferences held in FY 1981.

TABLE VI

NIH SPONSORED NUTRITION CONFERENCES, FY 1981

INSTITUTE	DATE	TITLE
NHLBI	Oct. 7, 1980	Symposium on Current Issues in Hypertension
NIGMS	Oct. 9-10, 1980	Second Conference on Supportive Therapy in Burn Care
NCI	Oct. 17, 1980	Effect of Diets on Animal Studies Related to Toxicology
NIADDK	Nov. 15-16, 1980	Conference on Metabolic and Clinical Implications of Branched Chain Amino and Keto Acids
NHLBI	Dec. 3-5, 1980	The U.S.-Italy Joint Symposium on Nutrition and Cardiovascular Disease
NCI	Dec. 11-12, 1980	Research Needs for Nutrition and the Pediatric Cancer Patient
NCI	Mar. 4-6, 1981	Molecular Interrelations of Nutrition and Cancer: Thirty-Fourth Annual Symposium on Fundamental Cancer Research
NHLBI	Mar. 9, 1981	Jerome Cornfield Memorial Symposium on Biostatistics and Epidemiology
NEI	Apr. 6-10, 1981	Meeting on Support of a Nutritional Blindness Center in Hyderabad, India
NCI	Apr. 7, 1981	Diet and Breast Cancer Risk Working Session
NCI NHLBI	May 11-12, 1981	Workshop on Cholesterol and Non-Cardiovascular Disease Mortality
NIADDK	May 28-30, 1981	Workshop on Oral Retinoids in Dermatological Disease
NHLBI	June 7-9, 1981	Workshop on Hypertriglyceridemia: Mechanisms and Role in Atherosclerosis
NICHD	June 9-11, 1981	Determinants of Choice and Duration of Infant Feeding Practices
NCI	June 25-26, 1981	Chemoprevention Workshop of the Board of Scientific Counselors
NCI	June 29-July 3, 1981	VII International Symposium on Gnotobiology

NIADDK	July 21-31, 1981	Food and Nutrition Component of the Gordon Research Conference
NIADDK	Aug. 15, 1981	Workshop on Nutrition Research Needs in Asian Countries
NIADDK, FIC, and Other Sponsors	Aug. 16-21, 1981	XII International Congress on Nutrition
NIADDK	Aug. 23-27, 1981	Fifth International Conference on Proteins of Iron Storage and Transport
NICHD	Aug. 31-Sept. 9, 1981	Milk Banking Methodology
NCC	Sept. 16-18, 1981	Conference on the Assessment of Nutritional Status
NICHD	Sept. 16-18, 1981	Trace Element Regulation of Immunity and Infection

THE INTRAMURAL RESEARCH PROGRAM

The total cost of the NIH intramural program in biomedical and behavioral nutrition research was $9,893,000 for FY 1981 (see table I). Institutes supporting intramural research in nutrition include NCI, NHLBI, NIDR, NIADDK, NIAID, NICHD, NEI, NIEHS, and NIA. Most of this research takes place on the NIH campus in Bethesda; however, the NIEHS staff conducts research in Research Triangle Park, North Carolina, and the NIA intramural program is located at the Gerontology Research Center in Baltimore, Maryland.

Intramural research projects include prospective randomized clinical trials, longitudinal studies on the metabolism of nutrients and on food toxicity in healthy volunteers and patients with various disease states, and animal studies. Among the ongoing long-term studies that continued during FY 1981 are: the U.S. cancer mortality survey, in which the role of nutrients in cancer mortality is an important component; studies on the effects of total parenteral nutrition in cancer treatment; the Type II coronary intervention study, which seeks to determine whether lowering LDL cholesterol will slow, stop, and/or reverse the progression of coronary artery disease in patients with hypercholesterolemia; and longitudinal studies on human aging.

The NCI has several research projects evaluating the relationship between nutrition and cancer etiology. Cross-cultural surveys and case control studies are under way to study the incidence of bladder, breast, colon, and other cancers in regard to dietary patterns among target groups. These projects are attempting to isolate nutritive factors in cancer etiology from other variations in lifestyle among the study groups. A NCI study is looking into the carcinogenicity of foodstuff contaminants and artificial sweeteners in primates. Two other investigations address the effects of specific fatty acids and lipotropes in modifying the uptake and resistance to carcinogens in mammary and liver cells. The impact of manipulation of hormones and dietary lipid intake on mammary tumor incidence is also being evaluated.

Basic research in energy exchange and expenditure, conducted on experimental animals, involves the use of whole-body calorimetry to investigate differences between normal and tumor bearing animals. In addition, these experimental studies should elucidate the physiological basis of cachexia, which often characterizes cancer patients.

The NCI is actively involved in assessing the efficacy of TPN as a means of nutritional support for the cancer-bearing host. Prospective randomized protocols for the use of TPN as an adjunct to aggressive chemotherapy and radiation treatment are under way. In addition, the NCI intramural program operates a large service component in which patients receiving TPN at NIH are studied for deficiencies in vitamins, trace metals (zinc, copper, chromium), essential fatty acids, and efficacy of TPN. Studies are done on gluconeogenesis, protein synthesis, glucose disposal, body composition of potassium, alanine kinetics, mineral balance, and requirements for all known nutrients.

The bulk of the NCI intramural research lies within the general category of skin cancer chemoprevention through the use of vitamin A. Several researchers are analyzing the morphological effects, biochemical mechanisms, metabolic pathways, and dose toxicity of synthetic vitamin A (13-cis-retinoic acid) and its analogs in cell cultures and laboratory animals. These studies should provide information on the cellular and molecular basis of skin carcinogenesis as well as the therapeutic value and anti-promoting properties of vitamin A, before and after the onset of malignancy.

Scientists in NHLBI are working toward delineation of the molecular and structural properties of the human plasma apolipoproteins, the physiological role of the apolipoproteins and lipoproteins in lipid transport, the determination of the mechanisms involved in regulation of cellular cholesterol metabolism and transport, and the elucidation of the metabolic and molecular mechanisms involved in plasma lipoprotein biosynthesis, transport, and catabolism in normal individuals and patients with disorders of lipid metabolism and atherosclerosis. Other research is exploring iron chelation in transfusional hemosiderosis, hematopoiesis in bone marrow failure, biochemistry of the spontaneously hypertensive rat, regulation of tyrosine hydroxylase in the central nervous system, and metabolism of lipids in human fibroblasts and muscle cells grown in culture.

Intramural research at NIDR includes studies on the cariogenicity of foods and the taste of food as it relates to the nutritional intake of infants and adults.

The NIADDK conducts nutritional studies directed toward (1) determining the nutritional, biochemical, and metabolic roles of a variety of nutrients considered to be essential in the diet and (2) measuring the effects of different levels of nutrient intake on tissue levels of various metabolites in laboratory animals. These studies relate to dietary measurements, nutrient bioavailability, nutrient interactions, nutrient status, and metabolic function. Special emphasis is being given to vitamins A and E, folacin, and zinc.

Intramural clinical research is also conducted on nutritional factors that relate to etiology, morbidity, and mortality of metabolic and other diseases. Of special significance are studies on: (1) bone metabolism and osteoporosis; (2) pathogenesis of human cystinosis; (3) effects of weight reduction on glucose tolerance and glucoregulatory hormones; (4) followup on infants fed infant formula deficient in chloride; (5) malabsorption, fatty acids, and membrane function in cystic fibrosis; and (6) lipoprotein composition in Indians and Caucasians. Other studies include traumatic shock and cellular immunity, mechanism of action of pyridoxal phosphate, hepatic and intestinal function, role of dietary fat in regulating adipose cell function, $(NA^+ + K^+)$ATPase activity in obese subjects, and transport of lipids, hormones, and enzymes.

An NIAID researcher is investigating the mechanisms of food allergy, focusing on the mechanisms of basophile and mast cell histamine and leukotriene release in the bowel, and ways in which food substances trigger that release. Histamine and leukotrienes are the pharmacological substances in the body which produce the tissue reactions recognized clinically as being allergic. Thus they may be responsible in part for the gastrointestinal upset, rashes, and other signs and symptoms of food allergies.

Numerous intramural nutrition research projects are carried out by NICHD. Scientists are studying the way in which a cell coordinates the expression of its genetic repertoire during nutrition deficiency, the electrophysiological effects of long chain free fatty acids on spinal cord cells in tissue culture, and trends in breast and bottle feeding among Pima women of the Gila River Reservation in Arizona. Researchers are also working to improve the therapy of severe hypoglycemia and the nutritional therapy of glycogen storage diseases; in collaboration with scientists from the National Institute of Mental Health, NICHD researchers have established a protocol to study the effects of sugar on hyperactivity in children whose parents have observed that dietary sugar incites hyperkinetic behavior.

In other NICHD research, scientists are working to develop new stable isotope probes to study human calcium metabolism in lactation and in various metabolic disorders, such as dystrophic calcification. In attempts to better understand the phenomenon whereby changes in nutritional environment during development and growth modify differentiation and maturation of cellular processes, researchers are continuing their investigations of nutritional modulation of genetic expression in the developing mammalian pancreas. Research is continuing, too, on various inborn errors of metabolism, including glutathione synthase deficiency, glucose-6-phosphate dehydrogenase deficiency, cystinosis, homocystinuria, phenylketonuria, adrenal leukodystrophy, and galactosemia; various kinds of experimental nutritional therapies are being investigated in these disorders. Investigators are also attempting to ascertain if vitamin E administration will reduce neonatal hyperbilirubinemia secondary to glucose-6-phosphate dehydrogenase (G6PD) deficiency, and whether vitamin E administration will reduce the frequency and severity of the acute hemolytic crises responsible for the major morbidity and mortality in this prevalent genetic disease. The effects of beta-carotene, another antioxidant, in chronic severe G6PD deficiency are also being examined.

In the NEI intramural research program a specific enzyme defect has been identified as the cause of a rare form of inherited retinal degeneration, gyrate atrophy. A corrective diet has been designed for affected patients which has been shown capable of reversing the visual effects of this disorder. Studies involving vitamin A (retinol) play a major role in NEI intramural research. Although the special role that vitamina A plays in vision is well known, the more general role this vitamin and its derivatives play in differentiation and maintenance of ocular epithelial tissues is less well understood. NEI scientists have developed preliminary biochemical data which shows that a normal metabolite of retinol, retinoic acid, has a specific cell receptor on both normal retina and retinoblastoma cell nuclei in culture. This may provide important additional information on the role of retinol in vision and the role of its derivative retinoic acid in the maturation and maintenance of epithelial cells.

Other NEI intramaural investigators are studying the interrelationships of vitamin E and A in maintaining structural components of the retina in four groups of weanling rats fed purified diets adequate or deficient in each vitamin. In the normal retina, lipofuscin deposits build up as organisms age. Results from this study to date have indicated that when vitamins A and E were present in sufficient quantities, the lipofuscin granules did not accumulate; however, there was an accumulation when either or both vitamins were deficient in the diet.

The corneas of retinol deficient rats maintained on low levels of retinoic acid in a conventional laboratory environment, and corneas from retinol deficient rats receiving no retinoic acid or retinoic acid for 5 weeks and kept in a germfree environment, were examined for structural abnormalities before the onset of apparent xerophthalmia. All groups of deficient rats showed abnormally large numbers of exfoliating cells, increased density of keratofibrils throughout the epithelial layer, decreased glycogen content, deposits of electron dense particles in the basal lamina region, and accumulation of electron dense bodies in the keratocytes. These changes probably occurred as a primary effect of vitamin A deficiency. However, the absence of neovascularization and inflammation of the corneal stroma in the germ free rats suggests that these changes may be secondary, perhaps due to infection.

The intramural nutrition research of NIEHS focuses on development of approaches to study the regulation of gastrointestinal functions. Of particular concern are regulation of intestinal absorption and metabolism, and responses related to oral exposure to toxins. Current examples of these studies are the role of L-glycerol-3-phosphate in colon energy metabolism, NAD linked L-glycerol-3-phosphate dehydrogenase in the metabolism of methylazoxymethanol and tumorogenesis, factors involved in relative rates of intestinal tip and crypt cell protein synthesis by 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The regulation of these processes is examined at the cellular, subcellular, and molecular levels.

NIA intramural scientists are studying several aspects of nutrition as they relate to aging or the aged. A major area of interest is the mechanism(s) by which undernutrition increases life span. One hypothesis under study is that dietary restriction increases life span by reducing the use of the genetic code and thus minimizing genetic imperfections which may accumulate in later life. Two invertebrate model systems have been established for this purpose. Another study involves the effects of nutritional restriction on the age-related loss of dopamine receptors.

An important aspect of the intramural program involves human studies relating aging, nutrition, and energy metabolism; studies, for example, on the secretion and action of gastric inhibitory polypeptide, on the relation between body weight and morbidity and mortality, and on the effect of dietary chromium on tissue sensitivity to insulin. Techniques for accurate measurement of serum and urine levels of chromium have recently been developed, and are being used in a study to establish age and sex adjusted normal serum levels. Chromium has also been postulated to influence the development of coronary heart disease through its effect on lipid metabolism. This study will examine fasting chromium levels in individuals with and without coronary heart disease, and serum lipid levels prior to and following chromium supplementation.

Reports in the literature suggest that the rate of secretion and/or the composition of saliva are altered with increasing age. These findings are being re-evaluated as part of an assessment of the oral physiological status of a subset of participants in the Baltimore Longitudinal Study of human aging (BLSA). Work has been concentrated on (a) general demographic and dental descriptions of the participants, (b) evaluation of fluid output and exocrine protein secretion from stimulated parotid salivary glands, and (c) evaluation of taste acuity and taste intensity perception. Generalized age-related changes in salivary gland function were not found in this group of subjects, although specific age-related changes in electrolyte handling were noted. In a related study, age related changes in salivary gland function are being studied using both parotid and submandibular glands from young and aged rats; these studies have so far focused on the mechanism of protein synthesis and release, and on the control of gland function by neurotransmitters.

NIA intramural scientists, in collaboration with scientists at the USDA-Tufts University Center for Human Nutrition and Aging, have begun plans for a retrospective analysis of dietary data collected from participants in the BLSA. Participants during the years 1961 to 1965 and from 1968 to 1975 completed 7-day dietary diaries preceding each visit to the Gerontology Research Center. These visits are scheduled at 1- to 2-year intervals depending on the age of the subject. Nearly 200 participants completed at least one such diary in each of the three 5-year intervals

1960-1965, 1966-1970, and 1971-1975. The planned analysis will involve assessment of daily variability of nutrient intake as well as variability from one visit to the next for individual participants.

Supporting all the Institutes in their intramural research is DRS. The DRS laboratory animal nutrition research program works to improve the quality of laboratory animals being produced for research by improving their nutritional status. Series of feeding trials are designed to evaluate new diets and to determine the nutrient requirements of various strains or stocks of animals within a species. Data obtained from these studies form the basis for formulating diets having optimal nutrient concentrations for specific animals. These data are used to develop standard reference diets for use throughout NIH and the entire biomedical research community. Diets with either deficient or excess nutrient concentrations are evaluated to provide animal models with nutrition related diseases for study by NIH investigators. Studies are also conducted to develop satisfactory diets for the various animal species being introduced to biomedical research as new models.

The intramural nutrition research program of NIH complements and augments the extramural program by concentrating on research particularly relevant to the mission of the Institutes that utilize the facilities and scientific expertise available on the NIH campus.

NUTRITION RESEARCH TRAINING

The NIH supports training in biomedical and behavioral nutrition research in both the extramural and the intramural programs. Table VII summarizes the expenditures and the number of persons who received training in FY 1981.

TABLE VII

NIH TRAINING IN NUTRITION, FY 1981

Institute	M.D. Degree	Ph.D. Degree	Other Degree*	Pre-Doc	Total Number of Persons Trained†	FY 1981 Obligations (Dollars in thousands)
EXTRAMURAL:						
Institute Training Grants						
NCI	1	4	1		6	$ 270
NHLBI	3	38	1	8	50	1,165
NIDR		6	2	2	10	186
NIADDK	13	8		32	53	793
NIAID	1	3			4	10
NIGMS	27	1		64	92	473
NICHD	6	4	3	6	19	247
NIA			2	32	34	16
Subtotal	51	64	9	144	268	$3,159
Individual Fellowships						
NCI		1			1	19
NHLBI	2	1			3	42
NIDR			2		2	54
NIADDK	2	14	1		17	251
NICHD	3	1			4	84
NEI		5			5	68
NIA		4			4	32
Subtotal	7	26	3		36	$ 549
EXTRAMURAL SUBTOTAL	58	90	12	144	304	$3,708
INTRAMURAL						
NHLBI	6				6	$ 114
NIADDK	3	5			8	86
NICHD	9	2	1	—	11	500
INTRAMURAL SUBTOTAL	18	7	1	0	25	$ 700
NIH TRAINING TOTAL	76	97	13	144	329	$4,408

* Other Degree includes M.D./Ph.D, Ph.D./D.D.S., D.D.S, D.V.M., D.Sc., etc.

† Preliminary figures.

The number of trainees in human nutrition research supported by the NIH increased by more than 50 percent between FY 1978 and FY 1979, increased slightly between FY 1979 and FY 1980, but decreased by 9 percent between FY 1980 and FY 1981. Table VIII exhibits the number of extramural trainees and fellows and the associated expenditures in FY 1980 and FY 1981 both for NIH as a whole and for the nutrition program. The table shows that the decrease in number of trainees in nutrition parallels the decrease in total number of trainees supported by all of NIH.

TABLE VIII
COMPARISON OF TOTAL NIH AND NUTRITION PROGRAM SUPPORT OF
EXTRAMURAL RESEARCH TRAINING, FY 1980 AND FY 1981
(in thousands of dollars)

	ALL NIH			NUTRITION		
	FY 80	FY 81	Percent Change	FY 80	FY 81	Percent Change
Number of Trainees and Fellows	12,049	11,142	-8	335	304	-9
Expenditures	182,750	181,720	-0.6	3,829	3,708	-3

The research training activities in the extramural and the intramural programs are described below.

Extramural Training

Within the extramural program, two basic mechanisms are used for nutrition training support: institutional awards and individual awards.

The institutional national research service awards, commonly called "training grants," are designed to enable institutions to make training awards to individuals selected by them for predoctoral and postdoctoral research training. In FY 1981, this mechanism was used to train 268 persons in nutrition, for a total expenditure of $3,159,000. A total of 9,121 full-time equivalent research trainees were supported through training grants by all of NIH in FY 1981 for a total expenditure of $144,275,000. The number of trainees in nutrition supported by training grants is 2.9 percent of all the trainees supported by this mechanism by NIH. This support represents 2.0 percent of NIH expenditures for FY 1981 training grants.

The postdoctoral individual national research service awards, called "fellowships," are awarded to provide postdoctoral research training to individuals to broaden their scientific background and extend their potential for research. In FY 1981, the NIH supported 36 fellowships in nutrition for a total expenditure of $549,000 out of a total of 1,574 fellowships with a total expenditure of $30,897,000. The number of fellowships in nutrition was 2.3 percent of the total number for NIH and incurred an expenditure of 1.8 percent of the total NIH expenditure for fellowships. Therefore, in the extramural nutrition training program for FY 1981, including both training grants and fellowships, a total of 304 persons were supported at a total expenditure of $3,708,000. Thus, 3.0 percent of all NIH trainees were receiving training in nutrition in FY 1981. This effort accounted for 2.4 percent of NIH training expenditures.*

Examples of areas in which the trainees carried out their work include the following:

Experimental and clinical nutrition

Multidisciplinary problems of human health & food production

Effect of peptide hormones on food intake and body weight

Nature of feeding-induced rhythmicity in intestines

Pregastric satiety in experimental hyperphagia

Circadian rhythms and control of food intake

Regulation of lipolysis in animal and human obesity

Ontogeny of ingestion: early learning and sensory function

Behavior, nutrition, hormones and seasonal rhythms

Nutrition and arteriosclerosis

Role of insulin and diabetes mellitus in HDL metabolism

Blood pressure, lipids, and the vegetarian diet

Cardiac nutrition and pharmacology

Epidemiology of cancer

Carcinogenesis and drug development

Nutrition and health status

Alpha-andrenergic regulation of hamsters' brown adipocytes

Influences on preadipocytes in culture

Central & peripheral mechanisms of energy homeostasis

Bioenergetics of fasting and lactation

Studies of dietary effects on human adipose tissue

Ovarian hormones, food intake and lipid metabolism

Control of food intake: focus on nutrition and behavior

Metabolic regulation and weight control

Recovery of feeding behavior following brain damage

Lipid metabolism and atherosclerosis

Studies on lipoprotein metabolism

The interaction of dietary cholesterol and LDL on immune function and selected antifungal drugs

Nutrition in cardiovascular disease

Plasma cholesterol ester exchange activity

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* All figures referring to overall NIH research training were supplied by DRG as of August 1982.

Role of cell surface glycoproteins in breast cancer

Research in burns and trauma

Dietary zinc and oral epithelial changes

Calcium and control of lacrimal gland secretion

Penetration and metabolism of retinoids in the cornea

Vitamin E requirements during parenteral nutrition

Target organ insensitivity to $1,25\text{-}(OH)_2\text{-}D_3$

Cutaneous formation and administration of $1,25\text{-}(OH)_2\text{-}D_3$

Mitochondrial aspects of pyridoxine metabolism

The chemistry of vitamin B_{12}

Mechanisms of the molybdenum/copper antagonism

The copper deficient rat lung as a model for emphysema

Evaluation of glucose metabolism in combination with exercise in aging humans

Hypothalamic catecholamines, prolactin and the development of spontaneous mammary and pituitary tumors in aging rats

Fatty acid and glucose utilization of the brain with aging

Pediatrics, prematurity, and the newborn

Surface membrane antigens in mammary tissue

Nutritional effects on polymorphonuclear function

Nutrition and oral health

Effect of high levels of fluoride on developing tooth enamel

Interrelationships between nutrition and dental caries

Effects of vitamin E on ocular angiopathy

Vitamin A transport in ocular and other tissues

Vitamin A and epithelial glycoprotein synthesis

Experimental xerophthalmia & keratomalacia in vitamin A deficiency

Herpetic eye disease: antiviral actions of retinoids

Synthesis and metabolism of vitamin D analogs

Characterization of vitamin D-like substance

Vitamin B_6 and tryptophan metabolism in pregnancy

The effect of methionine deficiency on carnitine metabolism

Growth hormone and somatomedin in models of malnutrition

Bilirubin glucuronyl transfer in intestinal mucosa

Child malnutrition: Sudest Island Region, New Guinea

Nutrition and gastroenterology

Nutritional state on nuclease digestion of chromatia

Dietary zinc and oral epithelial changes

Environmental and food toxicology

Intramural Training

Within the NIH intramural program, three Institutes, NHLBI, NIADDK, and NICHD, supported training of 25 scientists at an obligation of $700,000 in FY 1981.

The intramural trainees worked in the following areas:

- Clinical studies in cystic fibrosis
- Obesity
- Transport of lipids, hormones and enzymes in tissue cells and membranes
- Role of free and lipid-bound inositol in brain and cell membranes
- Role of dietary carbohydrate and fat in modifying insulin's action
- Diabetes
- Hypoglycemia
- Methylmalonic aciduria
- Growth retardation in children with cystinosis
- Growth hormone studies
- Biochemical studies of hepatic and intestinal function
- Relation of prostaglandin to lung development
- Synthesis of prostaglandin in normal and transformed cell liver
- Mechanisms of food allergy

HIGHLIGHTS OF SPECIAL INTEREST AREAS IN NUTRITION

In this section of the report, highlights and accomplishments of nutrition research are presented in 12 different scientific areas and in 3 areas of nutrition education. Grants and contracts pertaining to each area were designated by the program staff of the Institutes and DRR. The special interest areas, presented in decreasing order of expenditure, are:

Nutrition and Prevention of Disease

Nutritional Status

Behavioral Studies in Nutrition

Child and Infant Nutrition

Research on Vitamins

Epidemiological Research in Nutrition

Nutrition and Obesity

Nutrition and Genetics

Total Parenteral and Enteral Nutrition

Nutrition and Aging

Maternal Nutrition

International Research in Nutrition

Nutrition Education for Professionals

Nutrition Education for the Public

Nutrition Education Research

Table IX presents the number of grants and contracts in each area; the expenditure of the nutrition component of grants and contracts in that area; and the percentage of the total FY 1981 nutrition obligation of $148,501,000. Each project, i.e., a grant or contract, could appear in more than one special interest area. For example, a study on nutrition and genetics that has as its main objective to prevent the onset of disease in a child would appear in the following categories: nutrition and genetics, nutrition and prevention, and child and infant nutrition. Therefore, the sum of each column in this table will exceed the corresponding quantities for the nutrition program as a whole.

The NIH nutrition program is presented in terms of these 15 special interest areas because of the scientific and political interest that has surrounded these particular aspects of nutrition research in the most recent past.

TABLE IX

SPECIAL INTEREST AREAS IN NUTRITION--SUMMARY TABLE

Special Interest Area In Nutrition	Number* of Grants and Contracts	Expenditure* (Dollars in thousands)	Percent** of Total
I. Research			
Prevention of Disease	667	$ 63,803	43.0
Nutritional Status	261	34,520	23.2
Behavioral Studies	226	25,786	17.4
Child and Infant	234	23,741	16.0
Research on Vitamins	385	23,294	15.7
Epidemiological Research	182	21,569	14.5
Obesity	177	16,713	11.3
Genetics	130	14,071	9.5
Total Parenteral and Enteral	73	11,591	7.8
Aging	125	10,236	6.9
Maternal	82	7,663	5.1
International Research	34	1,998	1.3
II. Education			
Education for Professionals	95	11,639	7.8
Education for the Public	26	2,769	1.9
Education Research	26	2,677	1.8

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*A grant or contract may be assigned to several special interest areas.

**The total expenditure of the nutrition program in FY 1981 was $148,501,000

Nutrition and Prevention of Disease

Support for nutrition research on disease prevention and the development of information leading to preventive measures is a major priority for many of the NIH Institutes. The NCI, NHLBI, NIDR, NIADDK, NIAID, NICHD, NEI, NIEHS, NIA, and DRR supported nutrition research in this area for a total of $63,803,000 or 43 percent of the total NIH expenditures for nutrition research in FY 1981.

The definitions for prevention used by the NCC are as follows:

> Primary prevention. Actions to promote health or undertaken prior to the development of disease.
>
> Secondary prevention. Detection of disease in its early (asymptomatic) stages and intervention to arrest its progress.
>
> Tertiary prevention. Intervention after the development of a clinically manifest disease in order to reverse or arrest its progression.

Much of the research in this special interest area deals with defining the specific nutritional needs of the fetus and neonate in an attempt to prevent intrauterine growth retardation and to assure optimal fetal development, and the birth and subsequent growth of healthy babies. Research on optimal nutrition therapy for high risk infants, especially those born prematurely, aims to identify and preserve specific components of human milk and colostrum. Results from this kind of research will help to minimize the problems of failure to thrive, growth retardation and newborn infections.

Additional research on infant feeding has helped to uncover another cause of crib death, also known as sudden infant death syndrome. Investigators have produced data suggesting that diet may foster infant botulism, a disease in which spores of C. botulinum germinate, multiply and colonize in the bowel and produce botulin toxin. This toxin produces a spectrum of disease of varying clinical severity that can be manifest in its extreme form as crib death. It has been proposed that intestinal toxigenic infections may be facilitated by infant formulas containing iron, whereas breast feeding is thought to attenuate or prevent infant botulism.

Other health problems of infants and children which may be prevented or ameliorated by the appropriate nutritional support are the various inborn errors of metabolism such as phenylketonuria (PKU), gastrointestinal disorders such as lactose intolerance, necrotizing enterocolitis, celiac disease, and food hypersensitivity. The aim of research in these conditions is to alter appropriately the availability of nutrients so that exposure to harmful substrates is minimized. Preventive goals include mitigating the severity of such diseases or preventing their expression altogether.

One study of PKU indicates that children who abandon the special low phenylalanine diet at the age of 6 years do not experience major adverse sequelae. These children, however, do not perform as well in school as those who continue on the diet despite similar mean IQ's. The age of diet discontinuation therefore may need to be reassessed.

In another study of PKU, investigators attempt to determine the phenylalanine levels of maternal blood that will not damage the central nervous system of the fetus. Information of this kind will help to successfully treat the hundreds of women with PKU who are now approaching their reproductive years.

Preliminary research results indicate that vitamin E is important to the prevention of bronchopulmonary dysplasia in artificially ventilated infants. A study of the impact of nutritional deficiences, other than vitamin A, on the eye is planned in India. This research will consider possible risk factors that make the malnourished child especially susceptible to blindness.

In order to fully understand the role of nutrition in human development and disease prevention, its interactions with various cultural and behavioral environments need to be examined. This research has important implications for preventing diseases that stem from allergic or idiosyncratic reactions to certain foods such as milk, wheat, soybeans, and various food additives. In addition, studies are also under way on the interaction between nutrients and exposure to environmental contaminants, and the effects of ingested contaminants on the digestive system including the mechanisms of transport across the intestinal wall. The interactive relationships between exposure to environmental contaminants and nutritional factors (e.g. fasting, dehydration, dietary deficiencies and supplements) are explored in terms of the effect on toxicity and possible pathogenesis.

The home environment and behavior modification techniques are being assessed in terms of their role in helping obese children to lose weight. In one behavior modification study the obese children, who were awarded money for weight lost, shed significantly more weight and kept it off during both treatment and followup. Projects such as this one attempt to expand knowledge on how behavioral aspects of the environment affect children's nutritional status and may help prevent diseases later in life.

Much of the research attempts to develop ways to modify and improve unhealthy practices, especially among nutritionally vulnerable groups, such as pregnant women, young children and adolescents. Research in pregnant women has found that as the mother's social class decreases maternal smoking has an increased effect on perinatal mortality. Nutritional supplements taken during pregnancy appear to protect against the low birth weights of newborns born to poor mothers who smoke heavily.

Studies of adolescent nutrition address the issues of nutrient requirements during adolescent pregnancy and during the adolescent growth spurt, as well as the increasing problem of adolescent obesity. Much of the research in this area is devoted toward the prevention of obesity and its metabolic concomitants such as glucose intolerance and insulin resistance, as well as towards the nutritional antecedents of other adult diseases. The development of healthy American adolescents who attain their genetic growth potential without the problem of overweight or obesity is a major priority in the area of nutrition and prevention.

A prospective study of a free-living elderly population is examining the role of nutrients at the level of the Recommended Dietary Allowances in preventing increased morbidity and mortality with age. Prelimiary data indicate that this population's intake of energy, vitamins, and minerals are adequate, with the possible exception of the intake of calcium and vitamin D in women.

Osteoporosis, thinning of bones, is a common disorder in women over the age of 50 years. Often regarded as a manifestation of the aging process, osteoporosis is a disease of negative calcium balance and other factors. Investigations suggest an association between age and plasma concentrations of $1,25(OH)_2$ vitamin D and an association between plasma $1,25(OH)_2$ vitamin D and the presence of osteoporosis. One study is examining the interactions of vitamin D metabolites, calcium and parathyroid hormone with reference to bone resorption and bone-blood calcium equilibrium. Data suggest that $1,25\text{-}D_3$ is the most potent metabolite for raising plasma calcium levels.

Another group of studies deals with the immune system and the modulating effects of specific nutrients on immune function and resistance to infections. Studies have shown that normal human serum contains an antibody directed against iron chelating compounds (enterochelins). These compounds are produced by pathogenic bacteria that compete with transferrin in the serum; iron is necessary for the bacteria to grow and become virulent. The antibody in human serum is of the IgA class and produces bacteriostasis of organisms by preventing the uptake of iron saturated enterochelin by these organisms. These investigations therefore provide fundamental new insights on mechanisms of microbial pathogenesis and host resistance to infection.

Other studies on nutrition and prevention of disease are looking at the role of diet in the prevention of diseases such as cancer, cardiovascular disease, atherosclerosis, hypertension, adult onset diabetes, dental caries, diverticulosis, etc. A number of studies seek to determine whether dietary and environmental factors serve as risk factors in the etiology of various site-specific cancers, particularly the breast, stomach, and colon. Studies of breast cancer are looking at the genetic predisposition of young women to nutrition-related malfunction of the immune system that permits the process of carcinogenesis.

Observations of high and low risk groups with different dietary habits are comparing the cocarcinogenic effects of polyunsaturated versus saturated fats in the formation of mammary tumors; determining the effects of hormone levels, particularly estrogens, on the promotion of mammary tumors; and considering the relationship between dietary fats and hormone levels. The role of hormones in relation to genetic, viral, chemical and nutritional factors in breast cancer development is a major area of study.

Epidemiological studies are also under way on the etiological factors common to childhood cancers; and on the consumption of various alcoholic beverages and the subsequent development of cancer of the oropharynx, larynx, esophagus, stomach, pancreas, lungs, liver, colon, and rectum. Investigators seek to determine whether the increased risk of cancer seen with alcohol consumption is due to the ethanol content or to the possible contaminants or cogeners present in the beverages. Studies are comparing clear and smoky liquors, beer, and red and white wines. Another risk factor also considered in these studies is smoking frequency or the use of tobacco.

The role of other dietary factors, especially vitamins, are under investigation for their possible tumor inhibiting effects. The anticancer properties of vitamin A and the retinoid analogs, vitamins B_6, C, and folic acid are of particular research interest. The role of antioxidants such as vitamin E, selenium, butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) in chemical carcinogenesis is another area of study.

Other dietary factors investigated for their possible role in carcinogenesis include caffeine, artificial sweeteners, trace minerals such as zinc, and fiber. In addition, methods are being developed to detect, identify and classify nitrosamines that may be found in the food supply. The influences of various cooking methods and thermal processing that contribute to the occurrence of carcinogenic n-nitroso precursors are being studied, along with the biochemical activation reactions of carcinogenic nitrosamides and nitrosamines, and the genetic predisposition to sensitivity to nitrosamines.

In an attempt to help prevent cardiovascular disease a number of studies are looking at various risk factors; one, in particular, is the metabolism, structure, composition, and blood levels of high density and other lipoproteins. Another study to determine the effect of a vegetarian diet fed 3 weeks to healthy persons between the ages of 22 to 37 years showed a significant and rapid reduction in plasma cholesterol and LDL as well as HDL cholesterol. A similar study, carried out in monkeys, showed that alfalfa top saponins were successful in lowering plasma cholesterol levels without causing any danger of toxicity, or general changes in body weight and appearance.

Clinical trials such as the Multiple Risk Factor Intervention Trial (MRFIT), and the Lipid Research Clinics Coronary Primary Prevention Trial and the Dietary Intervention Study of Hypertension use counseling and other techniques to change dietary habits as one step in the prevention of heart disease and hypertension. The effectiveness of dietary therapy as an adjunct or substitute therapy for hypertensive patients on long-term drug therapy is also being studied by several investigators. Some of the results from the hypertension studies indicate that short-term hypertension control is feasible in the work setting; that age and weight of the person influence the incidence of hypertension; hypertension control is not affected by race, but is affected by sex (hypertension in women can be controlled better than in men); and dietary interventions have been successful in reducing sodium intake and body weight of hypertensives. Results from the MRFIT study to date indicate achievement of

75 percent goal in diastolic blood pressure reduction, a 50 percent goal in serum cholesterol reduction, and a 100 percent goal in smoking cessation.

A long-term epidemiological study, the Honolulu Heart Study has shown an inverse relationship between baseline serum cholesterol levels and colon cancer mortality in men, and an inverse relationship between alcohol intake (up to 60 ml of ethanol daily) and the risk of coronary heart disease incidence. Both of these findings require further investigation.

Dietary intervention studies have shown beneficial results in the treatment of adult onset diabetes. Diets high in complex carbohydrates (75 percent of calories) and high in dietary fiber (50 grams) fed for 16 days to patients with adult onset diabetes appeared to have the following results: the insulin requirement was lowered from an average of 27 to 7 units daily; glucose control was improved; and serum cholesterol and triglyceride levels were reduced. Insulin therapy was eventually discontinued in 15 of the 20 lean patients. Addition of plant fibers (pectin and guar gum) to the diets of diabetic patients resulted in significant reductions in postprandial hyperglycemia. When hydrated, these fibers form gels in the small intestine and colon, and such a gel may delay the rate of absorption of carbohydrates and largely prevent the peaks and valleys in blood glucose concentration.

Other studies on fiber seek to determine the chemical characteristics of various fiber components, develop appropriate methods for measuring dietary fiber and evaluate the effects of the forms and sources of dietary fiber on the bioavailability of nutrients. Some natural fiber sources are reported to have marked adverse effects on the bioavailability of nutrients and others very little. As a result of the discrepancy, studies are under way to compare the effects of cellulose, xylan, pectin, and cornbran on the bioavailability of calcium, magnesium, phosphorous, iron, copper, zinc, and selenium.

Animal studies on the relationship of vitamins (such as vitamin A) and trace elements (such as zinc, strontium, cadmium, lithium and fluoride) to the development of dental caries are now in progress. Data show an increase in dental caries in rats with a vitamin A deficiency, as well as in those offspring of dams made zinc deficient during lactation.

Nutritional Status

Research on nutritional status supported by the NIH includes studies that relate to requirements for essential nutrients in terms of nutritional status throughout the entire life cycle, from fetal life to infancy, childhood, adulthood, and the aged. Such studies are carried out in normal subjects and in patients with various disease states. Thus, NIH-supported research on nutritional status includes research into the methods that measure nutrient concentrations; biochemical, anthropometric, and maturational indices of nutritional status; dietary recall; and food composition studies. Within the Federal Government, the NIH is the major agency for support of research for the development of methods that are used in nutrition surveys. NIH also carries out research, both basic and applied, that is essential for the interpretation of survey results.

In FY 1981 research on nutritional status was supported by the NIH for a total of $34.5 million or 23 percent of total nutrition research. Support in this area came from investigations by NCI, NHLBI, NIADDK, NIAID, NICHD, NIA, and DRR.

Reliable methods for assessment of nutritional status are needed in order to: 1) determine whether or not impairment of health is the result of inadequate or inappropriate diet; 2) establish the specific nature of any nutritional problem underlying such health impairment; 3) provide knowledge on which to base dietary treatments for improving health; and 4) permit evaluation of the effectiveness of nutritional treatments or interventions that may be undertaken to improve health.

The complexity of the interactions among dietary inadequacy, disease, and genetic and environmental variables makes it particularly difficult to establish whether health impairment is the result specifically of a nutritional problem or whether it is secondary to some other defect. These problems can be solved only through continuing basic research to expand knowledge of the patterns of biochemical, physiological, pathological and behavioral responses to deficits or excesses of nutrients and to improve methods of applying this knowledge in practical situations.

Nutritional status assessment of hospitalized patients and of persons at the extremes of the life cycle, premature or low birth weight infants, and the elderly, present specific problems and impose unusual nutritional demands that must be assessed individually, in addition to any general nutritional evaluation.

Methods for the assessment of nutritional status focus on measuring body composition; i.e., total body potassium, muscle and fat mass, total body content of elements in order to validate results obtained by simpler, usually less direct, methods such as skinfold measurements or other anthropometric measurements. Specific research on methods for measuring body composition are examining: trace mineral status, e.g., zinc via hair analysis; serum ferritin measurements; assays of tissue storage of folate; and assays of serum and tissue levels of other vitamins, such as A and E, fatty acids, and amino acid levels.

Improved methods for body composition that have been developed include serum ferritin measurements in iron storage disease using a radiolabeled antibody method, and a radioimmunoassay for measuring vitamin D and pantothenic acid. Work is continuing on developing an enzyme immunoassay for serum ferritin, a new assay for serum and stored levels of vitamin E, and assays for vitamin A transport proteins.

Body composition terminology and techniques require clear definition and coordination. Research dictates that detailed measurements of body composition by new techniques and measurements of serum ferritin concentration and excretion of specific metabolites such as 3-methyl histidine should be applied in studies of nutritional status.

Zinc requirements in children and adults is a major area of research interest. Areas of study include the effect of marginal zinc (or copper deficiency) on spermatogenesis and on immunocompetence. Trace mineral studies that use atomic absorption spectrophotometry are under way to establish the location of zinc, copper, manganese, and selenium within sperm cells. Animal studies have shown that diets deficient in zinc will impair immune function, especially T-cell mediated delayed hypersensitivity. The immune response is promptly restored when zinc is replaced in the diet.

Biochemical analyses of protein, lipids, vitamins, hormone and mineral composition of human milk and colostrum are also under study. A recent study on the trace mineral content and other micronutrients of human milk isolated a low molecular weight zinc binding glycoprotein with a molecular weight of 4,900; this peptide contains endogenous zinc and also specifically binds ^{65}Zn added to milk in vitro. Metallopeptides that bind manganese and chromium are now being investigated. In addition folate binding in human milk has been quantified at 10-20 nanograms/ml.

Many studies are also investigating the relationship of food intake, nutritional status and functional performance, especially in terms of immunocompetence, work performance, cognitive development, and reproduction. The assessment of immunological competence in relation to nutritional status requires exact knowledge of nutritional intake, metabolism, concurrent illness, exposure to infectious agents, duration of the deficit and genetic factors.

In a review of studies on work performance, it appears that high intensity exercise (> 70% VO_2 max) requires sufficient carbohydrates in the diet to maintain muscle glycogen stores, but lower intensity exercise (< 70% VO_2 max) can be performed normally after a period of adaptation to a low calorie carbohydrate-restricted diet.

More research is needed on the safety of strenuous exercise during severe dietary restriction of more than a few weeks duration; the appropriate protein and carbohydrate content of low calorie diets for maintenance of normal capacity for work of different kinds and intensities; the effects of exercise on preservation of lean body mass during weight reduction; and the effects of exercise on the requirements for micronutrients.

In trying to understand nutrition and behavior interactions, specific functions, such as attention span, memory, problem solving, language skills, etc., should be used as well as cognitive, emotional and social functions.

In hospitalized patients, especially surgical or cancer patients, maintaining an appropriate nutritional state is often difficult. In an effort to improve the nutritional support of cancer patients, nutritional assessment methods for measuring adipose, musculoskeletal, cardiac and visceral components of cancer patients with protein calorie malnutrition are being developed and immunological techniques are being evaluated. Standard techniques, as well as tools for measuring specific body pools of nutrients and body components of nutritional significance are under investigation. Changes in nutritional status parameters in patients with cancer and malnutrition are being monitored after special therapeutic diets are begun in order to evaluate any improvement in the quality of life, morbidity and mortality, organ function and tolerance of various therapeutic procedures.

In patients with hypercatabolic illnesses, the feasibility of using selected immunological function tests as a correlate of malnutrition is being investigated. Results from these studies indicate that no test of immunological function (polymorphonuclear leukocyte phagocytosis, serum opsonization, and acute phase protein levels) identifies satisfactorily the presence and severity of malnutrition in the hypercatabolic patient. Although transferrin and retinol binding protein levels were found to reflect protein deficiency, no immunological function tests were exclusively modulated by dietary nutrients. The underlying illness also modulates immunological function.

Noninvasive methods have been developed to assess the efficiency of carbohydrate absorption in patients with various diarrheal and enzyme deficiency states; the pulmonary excretion of gaseous hydrogen, ^{13}C-labeled CO_2 and methane are being measured.

Research on the assessment of nutritional status in the patient population is also a priority of the Clinical Nutrition Research Units. The nutritional status screening program of the CNRU at Vanderbilt University has identified (over an 11-month period) 1,360 patients (12 percent of total admissions) with probable malnutrition. Several of these patients were cases of protein calorie malnutrition that would have been missed prior to the implementation of the nutritional status screening program. Studies at the CNRU at the University of Alabama have shown that the average hospital stay of seriously burned patients was reduced from 35 to 28 days as a result of aggressive nutritional support measures.

Investigations of the nutritional status of populations attempt: to determine whether specific health impairments, attributable to inadequate or inappropriate diet can be identified in a significant proportion of the population; to establish the nature of the dietary problem responsible for any such impairment; to provide information as to whether some action should or can be undertaken to remedy any present or forseeable health impairment that may be identified; and to make possible the evaluation of any intervention that may be undertaken. A major research challenge is to improve the ability to differentiate between associations that are coincidental and those that are biologically significant as predictors of the health impairment under study.

The Multiple Risk Factor Intervention Trial was designed to ascertain whether a special risk factor intervention program to reduce elevated blood cholesterol, elevated diastolic blood pressure and cigarette smoking in men at increased risk of death from coronary heart disease would result in a significant reduction in mortality from this disease. Evaluation of the quality of dietary patterns, related specifically to dietary fat and cholesterol, forms an integral part of the intervention on hyperlipidemia. The active intervention phase of the trial continued through FY 1981 and terminated February 28, 1982; all participants were followed for at least 6 years.

In epidemiological studies and surveys of populations, nutritional status assessment takes advantage of methodology of several disciplines for screening individuals and for the assessment and monitoring of populations. When either an intervention program or survey is undertaken, standardized data collection and adequate data handling facilities ensure quality information which is available rapidly for analysis and utilization. Well documented data sets made available to agencies and scientists involved in studies of nutritional epidemiology will facilitate improvements in such studies.

An intervention project to assess dietary intake and nutritional status also requires data on food composition that accurately reflect the nutrients found in the food supply. Determining the reliability of food composition data is an ongoing process. Research must continue to be directed towards the development of improved methods of obtaining and analyzing food consumption data. Data on food consumption must also be integrated with information on health status, demographic characteristics, behavioral and particularly attitudinal measures.

Reimbursement agreements with USDA help to support updating and expanding Agriculture Handbook No. 8, the development of methods for analyzing food, and the means to obtain food composition data. Some of the nutrient composition work facilitated through two reimbursable agreements with USDA include: improving the measurement(s) of nutrient fiber; developing faster and more precise methods for fatty acid, tocopherol, and sterol determination; and refining automated procedures for lipid analysis. Analytical data have recently been compiled for publication on the neutral detergent fiber and simple sugar content of ready to eat breakfast cereals, lipid composition and inorganic nutrient content of cooked beef and pork, and assays of the sugar, sodium, potassium, and phosphate content of soft drinks. A third reimbursable agreement with USDA supports analyses of data for identifying food patterns and their correlates in the Lipid Research Clinics (LRC) Population Studies.

Measurements of nutritional status also include the assessment of nutrient intake or the establishment of specific dietary regimens for planning research diets. One study being carried out in 10 laboratories is looking at the effect of diet on the metabolism, structure, composition and blood levels of high density and other lipoproteins. Two standardization programs, one for HDL and one for apoprotein A-I, allow investigators to verify the intra- and interlaboratory accuracy and reproducibility of HDL cholesterol determinations and apoproteins. A central analytical ultracentrifuge laboratory at the Donner Laboratory in Berkeley allows investigators to send samples to a common laboratory for analytical analysis.

Behavioral Studies in Nutrition

Nutritional status depends not only on physiological regulation but also on motivation controlling food intake and food selection. Habits, social, cultural, and religious values influence variables such as taste, smell, gastric factors, humoral and metabolic factors that are integrated in the central nervous system and subsequently play a role in food aversions and preferences. Studies are under way to look at the role of learning and habit in food preferences and aversions, as well as the influence of excess or deficient intakes of various nutrients on behavior. In FY 1981, the NIH support for research in this area was $25,786,000 or 17 percent of the total NIH nutrition research expenditures and was supported by NCI, NHLBI, NIADDK, NINCDS, NICHD, NIEHS, NIA, and DRR.

Studies are under way on the behavioral effects of malnutrition including protein calorie malnutrition, iron and zinc deficiency, and lead toxicity. One study found that iron deficiency in Guatemalan infants from impoverished families had significantly retarded both mental and psychomotor development; oral iron therapy failed to reverse the deficits. The behavioral effects of lead exposure from dietary, maternal, and airborne sources are being assessed through neuropsychological performance tests of infants and school children with high and low levels of cord-blood and dentine lead respectively. Initial results indicate that children's behavioral outcome measures were dose related to lead, with the poorest performance associated with the highest levels of dentine lead.

A number of studies on the effect of social and cultural factors on dietary intake and nutritional status are examining the influence of social class on maternal weight gain and fetal outcome in mothers who smoke during pregnancy; the development of the child's conception of food and food avoidance; the effect of television food commercials on children's eating habits; an ecological assessment of nutritional status of families living in Kenya's Taita Hills; the effect of Westernization on infant feeding practices of Negev Bedouins; and infant feeding practices among the Pima.

Investigators have found that the psychological basis for food rejection by humans falls into four categories: distaste, disgust, toxic, and inappropriate (material not culturally defined as food). They also have derived better culture-specific definitions of food and nonfoods (e.g., sand, leaves, etc.).

Studies on television advertising indicate that commercials for candy and cola beverages significantly increased the calorie intake of 4- and 9-year-old boys, but not girls of the same ages; however, nutrition advertisements for milk and fruit did not affect eating behavior in any of the children.

Other studies under way in children seek to analyze food selection behavior and where necessary, modify it as one step in the potential prevention of hypertension, coronary heart disease, and other cardiovascular diseases. A program in the Chicago public schools seeks to influence children's attitudes, value judgments, and behaviors concerning food so they will develop a more healthful eating lifestyle; one which is thought to enhance coronary heart disease prevention. Nutrition counseling workshops and publications on the role of diet in cardiovascular disease also seek to effect similar changes in other age groups.

Research on obesity is broad in scope and ranges from basic biochemical studies to the clinical treatment of obesity. Studies on nutrition and behavior in relation to obesity consider various methods of weight reduction such as behavior modification; the effect of exercise in weight reduction campaigns; the physiology of appetite, satiety and hunger; and the role of the central nervous system.

Projects aimed at behavioral modification of dietary intake to control obesity through developing healthful lifestyles are also under way. Two projects are teaching positive health and dietary behavior to preschoolers in order to help forestall obesity later in life. In another study, parents are being trained to model appropriate eating or exercise behaviors for their overweight child(ren) to imitate.

Studies on anorexia nervosa, another serious health problem where behavior, appetite, etc., play a definite role, have shown the disorder to be the result of a phobia of ingesting food and gaining weight, and not the result of a true loss of appetite. Many anorexics maintain an avid interest or even obsession with food and flavors and do not report a loss of appetite or hunger.

A comprehensive approach to treating anorexia nervosa, that uses a combination of nutritional rehabilitation which is usually behavior modification, and long-term family and individual therapy has been successful in curing 80 percent of patients being seen by some clinicians in the General Clinical Research Centers supported by DRR. A team comprised of a psychiatrist, social worker, pediatrician or internist, and nursing staff are involved in the therapy.

The problem of anorexia is also being studied in cancer patients. Those with early tumors have a weight loss secondary to reduced dietary intake that is disproportionate with their tumor burden. A possible explanation is that certain metabolic changes caused by the tumor affect the appetite satiety center. Studies indicate that by manipulating the plasma concentrations of free or total tryptophan, or other competing large neutral amino acids, or by administering serotonin antagonists, physicians may prevent the development of anorexia. Another study seeks to determine whether taste aversion problems found in clinical radiation and gastrointestinal chemotherapy result from induced taste aversion. Other studies of nutrition, behavior and the prevention or control of cancer include the analysis of dietary and nutritional status data collected in specific geographic areas and for special cancer sites. It is a well established phenomenon that some measures that prevent or control cancer do involve changes in behavior.

Nutrition, behavior and changes with age is another area of investigation with studies under way on the differential decline of perceived sweetness with age. It appears that intermolecular hydrogen bonding of various sweeteners at receptor sites may decline with age, thus mediating the age related decline in the perception of sweetness. Another study is attempting to provide a basis for predicting the taste of a mixture from the knowledge of the taste of its components. Particular emphasis is on the taste of complex solutions that influence the taste of water.

Basic research in the area of nutrition and behavior includes: studies on the neuropsychology of ingestive behavior, including the role of hormones and other chemical messengers such as the neurotransmitters; the development of appropriate animal models of cobalamin (vitamin B_{12}) deficiency; and the effect of protein deprivation on central nervous system development and the resulting physiological and behavior changes. Studies on neurotransmitters are particularly of interest as researchers have found that dietary factors that influence insulin secretion may simultaneously affect amino acid uptake of the brain. For example, carbohydrate ingestion tends to favor brain uptake of both tryptophan and tyrosine that results in higher levels of serotonin and dopamine in the brain. The functional significance of increased amounts of neurotransmitters in man is not yet clear, but observations in animal models and preliminary work with selected patients suggest a potential application of oral tyrosine for reducing blood pressure; its use in Parkinson's disease and depression is also being studied.

Other animal investigations attempt to separate nutritional from environmental variables; some studies have shown that the handling of animals can produce behavioral effects as strong as those of undernutrition.

Child and Infant Nutrition

Every child born is a product of his or her genetic background that must bear the environmental influences of our time. Nutrition is one factor that plays a major role in the proper growth and development of infants and children. Women in the childbearing years are advised to maintain adequate body stores of vitamins and minerals so that their body is ready to handle the additional demand for nutrients that comes with pregnancy and lactation. In recent years, attempts to determine specific nutritional demands and to uncover the possible role of nutrition before and immediately after birth have led to exploring the environment of the fetus and the neonate. All NIH Institutes, except NEI and NIA, support research in child and infant nutrition. In FY 1981, $23,741,000, or 16 percent of the total nutrition expenditures, was devoted to research in this area.

In order to understand growth and development throughout the life cycle, research studies are underway to more fully explain the interactive role of the various nutrients in relation to early stages of growth and development for the premature low birth weight infant, as well as the normal infant.

Studies of premature low birth weight infants include attempts to ascertain the requirements for protein and energy, vitamins and minerals needed for the maintenance of acceptable rates of extrauterine growth and development. In these studies, the complex functions of the placenta are controlled for periods as long as several months; investigators are looking at various diets used in total parenteral and enteral nutrition, metabolic balance and calorimetry studies, and the study of colostrum and human milk from mothers who deliver at various gestational ages. It appears that the rate of extrauterine growth can be controlled by adjusting the nitrogen density of the supplied diet.

The controversy remains, however, regarding the proper protein intake for premature infants. Some investigators hold that protein intakes two to three times that supplied by human milk are needed to maintain a growth rate comparable to a fetus of similar age. However, there is no adequate evidence that postnatal growth rate should be based or extrapolated for in vitro growth rates. Other investigators believe that the unique composition of human milk makes it the ideal food, even for premature babies.

The issue of protein therapy for premature infants is compounded by the biochemical immaturity of these infants and their lack of the enzymes needed to manufacture tyrosine, arginine, cysteine and cystine, taurine and histidine. These amino acids, as well as the eight essential amino acids required by adults, are therefore essential for the proper nutrition of these infants and must be supplied by the diet. Provision of optimum nutrition to allow for subsequent growth of these infants is often hampered by inadequate knowledge of the effects of prematurity on the development of intestinal digestive and absorptive capabilities. Severe hyperglycemia, hyperammonemia and acidosis may ensue if the biochemical immaturity of these infants is not checked when supplying them with nutrient substrates.

Additional studies in premature infants are looking at retrolental fibroplasia that occurs with the inhalation of high oxygen concentrations. Determinations of optimum oxygen intake for premature infants and the possible benefits of vitamin E in overcoming this problem are under investigation.

In terms of mineral requirements in premature and in normal infants a number of developmental and clinical studies are investigating a possible correlation between zinc supplementation and growth velocity. Investigations include zinc balance studies in breast and formula fed premature and normal infants, and the study of zinc levels in infants with failure-to-thrive. Fluoride's role in the development of teeth and in caries resistance, and the role of vitamin A in tooth and bone calcification are also under study.

A noninvasive breath analyser has been developed to monitor the adequacy of carbohydrate absorption in neonates and should be useful in the assessment of their nutritional status.

A number of investigations are reexamining the composition of human milk and the special function served by many of its components. Recently identified components in human milk include: lysozyme and lactoferrin, two soluble proteins that inhibit bacterial growth in the gastrointestinal tract of human newborns, lactoferrin by binding the iron required for bacterial growth and lysozyme by bacterial lysis; secretory immunoglobins (IgA) that coat the newborns intestinal lining and which are directed specifically against bacterial antigens to which the mother and infant are exposed; macrophages and T- and B-lymphocytes that appear to play a role in neutralizing the effects of viruses, bacteria, bacterial toxins, and other foreign antigens, including allergenic food antigens; and unique growth factors (mitogens) that stimulate DNA synthesis and induce cell division in culture. This mitogenic activity is highest early in lactation and may play an important role in the growth of intestinal mucosal cells. One recent finding of interest is that milk secreted by women with cystic fibrosis does not differ significantly in composition from that secreted by healthy women.

Clearly, the biochemical, nutritional, immunologic and antiallergenic properties of breast milk contribute to improved nutrition and health and survival of infants. To date, workable methods for the collection, refrigeration and storage of human milk and colostrum which preserve the viable populations of immunologically active cells have been developed. Currently, techniques are being developed to combat viral contamination without destroying immunologically active cells or denaturing proteins that possess antimicrobial activity. Of particular interest in human milk banking are the maternal factors that influence composition of breast milk: maternal age, nutritional status, smoking, diet, time in the lactation period, etc.

Studies are under way on the physical and mental development of infants with various kinds of malnutrition including protein calorie malnutrition, specific nutrient deficiencies and excesses (e.g., iron deficiency or lead excess), or malnutrition brought about by inborn errors of metabolism. Undernutrition often occurs in various disease conditions such as cancer, as well as with the inborn errors of metabolism such as phenylketonuria, galactosemia, homocystinuria, and other disorders of sulfur amino acid metabolism.

Examples of specific research include: lactose intolerance in children; energy relationships in inborn errors of metabolism; the synthesis of polypeptides for phenylketonuria therapy; the use of analogs, keto acids, and amino acids as effective treatment in children with certain inherited metabolic defects of the urea cycle; inherited abnormalities of iron, copper and globin metabolism; the use of safflower oil in the treatment of essential fatty acid deficiencies in children; behavioral precursors of infant obesity, and early nutrition and the development of obesity.

One highlight of this research indicates that in those children with lactose intolerance, children with isolated lactase deficiency have higher levels of breath hydrogen which occur more rapidly after an oral load of lactose than do children with lactase insufficiency secondary to mucosal injury. Researchers also have discovered that an endogenous pool of glycoproteins in the intestine provides substrate for methane production, and that colonic methane generation is influenced by the coexistence of hydrogen producing flora and methogenic bacteria.

In children with juvenile diabetes mellitus, research is under way to determine if an increased intake of dietary fiber will help to lower serum and urine glucose levels. Studies to evaluate and validate the techniques for assessing the nutritional status of children with cancer include the investigation of possible etiological factors in childhood cancer, the use of these factors to identify individuals at high risk for childhood cancer, and the development of the appropriate methods for cancer prevention. Prospective studies are under way to evaluate the benefits and complications of several modes of nutrition support in children receiving multimodal treatment for stages II-IV Wilms' tumors, and the effectiveness of enteral and parenteral nutrition in children undergoing chemotherapy treatment for metastatic neuroblastoma.

Additional studies are investigating the use of thoracoscopy, cryosurgery, polyamine measurement, vindesine, and antibiotic regimens in pediatric cancer treatment. Protocols have been established for the treatment of metastatic osteosarcoma and histiocytosis X. Statistical and data management methods for cancer studies in children are being developed.

In studies of pediatric head trauma patients, the extent of hypermetabolism is being evaluated. Indices of hypermetabolism (oxygen consumption, nitrogen excretion, altered hormonal milieu) are being correlated with nutritional status, catecholamine levels, physiological reflections of increased sympathetic nervous system activity, and neurological outcome. It is hypothesized that sustained elevation of catecholamines will be found after head trauma which mediate profound changes in metabolism and may impede neurologic recovery. Efforts are being undertaken to improve neurologic recovery after head injury by appropriate nutritional assessment and therapy.

Research on the nutritional needs of infants and young children is also carried out by the Clinical Nutrition Research Units. A number of studies are looking at various effects of total parenteral nutrition in infants and young children, i.e., the effect of amino acid infusions, particularly cysteine and taurine on plasma amino acid levels; the metabolic fate of intravenous fat emulsions in infants; the effect of the quantity and source of calories on nitrogen balance--differences in energy intake markedly affect protein retention; net amino acid balance; and hepatic dysfunction during TPN. Additional research considers the growth and metabolism of very low birth weight infants on combined enteral/parenteral feeding programs; the effect of varying protein and energy intake on the growth and metabolism of term infants; the effects of maternal nutritional status on fetal and placental growth and function; the immunologic maturation of the breast-fed versus formula-fed infants; the net amino acid balance in different forms of renal acidosis; and the effect of medium chain triglycerides (MCT) and taurine in healthy, low birth weight infants with emphasis on the role of taurine in fat absorption.

A study concerning the transmission of agents from mother to child is under way in rats. It is examining the effect of different doses of polychlorinated biphenyl (PCB's), fed to lactating rats during the first week of lactation, on reproductive ability, mating behavior, and activity and learning of the female offspring when they reach adulthood. The goal of this study is to discover whether PCB exposure during a critical time in postnatal development produces adverse effects that are manifest as a premature onset of reproductive aging.

Additional animal investigations are under way at a regional primate research center in an attempt to develop the rhesus monkey as an animal model for prenatal and postnatal zinc deficiency. Previous animal studies have shown that zinc deprivation during the perinatal period is teratogenic.

Another investigation in animals is looking at Menke's kinky hair syndrome, a generalized abnormality in copper metabolism, in a mouse model. A recent finding from an animal study of the effect of maternal malnutrition offspring indicates that maternal malnutrition during lactation results in a decreased protein content of the synaptic plasma membranes (SPM) and decreased total activity of SPM and brain Na+-K+-ATPase in the developing offspring. Additional research on SPM and malnutrition is warranted.

Research on Vitamins

The NIH supports and conducts research on the metabolic functions of all essential nutrients. An area of special interest is research on vitamins. In FY 1981, NCI, NHLBI, NIDR, NIADDK, NINCDS, NICHD, NEI, NIA, and DRR spent $23,294,000, or 16 percent of total nutrition expenditures, on research that included research on vitamins as a major component.

Research on the fat soluble vitamins includes studies on vitamins A, D, E, and K. Appropriately, two-thirds of the research in this special interest area was devoted to vitamin A and retinoid analog studies. A large portion focused on the tumor inhibiting effects of vitamin A and the retinoid analogs in several organ sites, including the oral cavity, trachea, liver, pancreas, colon, bladder, breast and epithelial tissues. Studies are investigating breast, bladder and trachea carcinogenesis in the presence and absence of vitamin A; the use of topical carotenoid pigments in inhibiting the formation of ultraviolet light induced tumors; the effect of vitamin A on drug metabolism and the production of embryonic growth factor receptors on tumor cells; and the effect of retinoids on the morphology and differentiation of epithelial cell membranes. One study is looking at the optimium time lag between carcinogenic induction in the mammary epithelial cells and the beginning of retinoid therapy. Several research laboratories are synthesizing retinoic acid and retinoid compounds similar to vitamin A for in vivo studies.

Epidemiological studies are examining whether the presence of vitamin A in the diet of specific ethnic groups or residents of specific geographical areas correlates with the incidence of lung and other cancers. One study of diet and the incidence of colon and breast cancer is being carried out by a mail questionnaire.

In addition to studies of vitamin A and cancer, other investigators are also exploring the role of vitamin A in the differentiation of normal epithelial tissues in animals and in humans. The identification and chemical synthesis of active forms of vitamin A responsible for bone tissue differentiation could provide important new tools for the treatment of skin and bone disorders. In studies of the effect of vitamin A in the development of teeth, it appears that rats fed diets containing little or no vitamin A are more susceptible to carious lesions. Also, the role of vitamin A in fetal development and growth, as well as its placental transport is of particular interest.

Scientists working to elucidate the molecular mechanisms of vitamin A have discovered and recently characterized intracellular binding proteins for retinol and retinoic acid. The binding protein for retinol (cRBP) appears to deliver retinol to nuclei or rat liver cells. Binding studies that make use of [^{3}H] cRBP-retinol have shown that the retinol associates with the nuclear chromatin, but the protein itself does not remain bound. Presumably, this retinol chromatin interaction affects the genomic expression underlying cell differentiation. In other research on retinol binding proteins, retinoic acid was found to be preferentially taken up by the nuclei of retinoblastoma cells in culture.

Investigators are also studying rats fed low levels of retinol and raised in a normal or a germfree environment.

Vitamin A deficiency and protein calorie malnutrition is known to bring on xerophthalmia, an important cause of blindness in children in some developing countries. A study of risk factors, other than vitamin A deficiency, that make the malnourished child particularly susceptible to blindness is being developed in cooperation with authorities in India.

Studies on the metabolic pathways of vitamin D indicate that the conversion of 25-OH-D_3 to 23,25-$(OH)_2$-D_3 and subsequently to 25-OH-D_3-26,23-lactone is a major metabolic pathway in the kidney. This metabolite is biologically inactive in intestinal calcium transport and bone calcium mobilization of rachitic bone. Studies indicate that both reduced kidney function and vitamin D deficiency may reduce protein synthesis and increase protein degradation in the skeletal muscle of rats. The appropriate application of the assays for three vitamin D metabolites (25 hydroxy vitamin D, 1-25-dihydroxy-vitamin D, and 24,25-dihydroxy-vitamin D) can yield insight in both the normal handling of vitamin D as well as the perturbations in disease state.

Scientists have also observed an impaired production or breakdown of 1,25-dihydroxy-vitamin D_3 in patients on total parenteral nutrition, but further studies are needed to learn the significance of this observation. It is likely therefore, that persons with renal disease are apt to have problems related to the metabolism of vitamin D. Research has shown that they may become deficient in the active form of vitamin D (1,25-dihydroxy-vitamin D_3). Studies have identified and synthesized the active forms of vitamin D shown to be effective in treating metabolic bone disease (including renal osteodystrophy), hypoparathyroidism, and pseudohypoparathyroidism. The metabolism of vitamin D and its influence on calcium homeostasis is also of interest particularly in terms of the vitamin D requirements of term and premature infants. Thus, high pressure liquid chromatographic methods to measure vitamin D and its metabolites in breast milk are being refined. Research in this area is specifically helpful to the clinical problems of neonatal hypocalcemia, infantile rickets and osteopenia.

Basic and clinical research continues on the role of vitamin E and its analogs in the development of cancer, hemolytic anemias, retrolental fibroplasia, etc. In cancer research, the effects of megadose levels of vitamin E, with different levels of dietary polyunsaturated fatty acids on the incidence of cancer is being investigated. Several cancer studies are looking at the effect of varying doses of vitamin E, alone or in conjunction with selenium; vitamin E and selenium are being studied as possible inhibitors of breast and lung cancer. This inhibitory effect on carcinogenesis is being examined in the presence of chlorine and chlorinated compounds.

Research on the use of vitamin E in various hemolytic anemias are producing exciting results. The reducing potential of vitamin E appears to be beneficial in ameliorating the oxidative ravages caused by too little reduced glutathione in the hemolytic anemias of glucose-6-phosphate-dehydrogenase deficiency and glutathione-synthase deficiency.

Clinical investigations continue on the vitamin E requirements of premature infants and in the vitamin E content of breast milk. Vitamin E is often administered in relatively large doses to premature infants to ward off various diseases such as retrolental fibroplasia (oxygen-induced retinopathy of prematurity). One of the General Clinical Research Centers is attempting to determine the value of vitamins, particularly vitamin E in preventing this complication. New observations suggest that vitamin E, by scavenging oxygen radicals may hinder the ability of the baby's phagocytes to kill ingested bacteria. These observations are being evaluated in a prospective clinical trial.

The effect of vitamin E on vitamin K utilization is also under investigation along with studies to determine the properties of liver microsomal vitamin K dependent carboxylase and the vitamin K 2,3-epoxide-reductase. Drug interactions with the vitamin K epoxide-reductases are also under study.

A significant amount of research support is also given to the water soluble vitamins, particularly vitamins C, B_6, folate, and cobalamin. Research on nutrition and cancer includes studies of vitamin C, particularly its effect on the incidence, progression of severity, and mortality from spontaneous primary mammary carcinoma in mice. In order to better understand the body's need for ascorbic acid in various physiological states and its relationship to the etiology and treatment of various diseases, studies are under way in guinea pigs to develop methods for the kinetic analysis of its metabolism. These studies have characterized a two pool model and have demonstrated that ingested ascorbic acid has a profound effect on the size of body pools, half-life, and turnover rates of the vitamin.

Other studies of vitamin C conducted in guinea pigs are examining the relationship between vitamin C and drug metabolism. It appears that vitamin C depletion to near-scorbutic levels is required before any alteration in drug metabolism is observed. If this is the case in man, 90 to 100 days of total vitamin C restriction may be necessary before alterations in drug metabolism are observed. These research accomplishments have greatly expanded our understanding of the distribution and metabolism of vitamin C and indeed offer an appropriate animal model for further studies.

Studies of vitamin C status in man have looked at the relationship of vitamin C status in the elderly and the pharmacokinetics of caffeine. Pharmacokinetics were conducted during a baseline period with vitamin C intake within the normal range, followed by 5 weeks of restricted vitamin C intake, followed by 2 weeks of vitamin C supplementation (1,000 mg/day). Changes in plasma, whole blood, and leukocyte vitamin C occurred in parallel with changes in vitamin C intake. However, parameters of caffeine phamacokinetics did not change statistically in response to these changes in tissue levels of vitamin C.

Studies of the B vitamins are another area of research interest. Research findings have demonstrated the widespread occurrence in animals of a pregnancy specific riboflavin binding protein. Other studies have identified a specific immunoglobin G subfraction that appears to serve the same function in humans. This finding is a good example of the significant gain in fundamental knowledge that has real relevance to human health. In other research on riboflavin, it appears that riboflavin status affects the activity of vitamin B_6 phosphate oxidase as this enzyme has a flavocoenzyme requirement. Information on the control and mechanisms of the enzyme helps to explain the subcellular, cellular and even microscopically observed vitamin B_6 deficiency attendant to riboflavin deficiency. Studies on the transport of vitamins into the spinal fluid emphasize the pharmacokinetics of riboflavin and thymidine in the nervous system.

Studies on folate consider its possible role in the rescue of normal cells from lethal doses of methotrexate used to treat lymphoma in mice; the mechanisms of folate and B_{12} uptake in lymphocytes and other mammalian cells; the effect of alcohol and drugs on folate metabolism; and folate uptake in breast-fed infants. Studies on human milk have identified a factor that enhances folate uptake by intestinal cells, while complementary studies have isolated a receptor protein from intestinal cells that binds this factor. These observations indicate that protein mediated folate absorption occurs in breast fed infants.

The embryotoxic risks of folate deficiency induced by the anticonvulsant drug phenytoin is given particular attention. Research data suggest that the high incidence of congenital malformations in phenytoin administration may be induced by a decrease in the availability of folate. Oral administration of phenytoin has been shown to reduce the levels of plasma folate in man and in two strains of mice, but not in rats or guinea pigs.

The interaction of folate and vitamin B_{12} (cobalamin) has been successfully examined through the development of the fruit bat model. This model also permits studies of cobalamin's role in the development of neural and other tissues; a deficiency in vitamin B_{12} shows up as structural and biochemical changes with possible myelin damage in nervous tissue. Cobalamin has been shown to play a role in leukocyte function and presumably in resistance to infection. In one study, cobalamin affected protein synthesis and cell division of lymphocytes, as well as the hexosemonophosphate shunt activity of human granulocytes.

Studies are under way on thiamine's role in the function of the central nervous system. One research effort is concerned with the role of thiamine in neurotransmission and the mechanism of the demonstrated central nervous system dysfunction in early stages of thiamine deficiency. The neurodegenerative condition known as Leigh's disease appears to be characterized by a disordered metabolism of thiamine-phosphate-esters in the brain. Investigators are attempting to purify cerebral thiamine-diphosphatase (TDP) and are measuring the cerebral synthesis of thiamine-triphosphate (TTP). TTP synthesis is blocked by an unknown factor found in urine of patients with Leigh's disease. In addition, studies are also investigating the interaction of thiamine pyrophosphate and branched chain ketoacid-dehydrogenase (BCKD). Thiamin appears to function at the site of enzymatic activity and produces a conformational change in BCKD that renders the complex more stable.

Other studies in this special interest area include research on the metabolism of biotin and choline; vitamin requirements specific to parenteral nutrition therapy; and the role of vitamins, particularly C and E, in the formation of nitrates in the intestine.

Epidemiological Research in Nutrition

The NIH is the lead agency in epidemiological research in nutrition. The role of food habits and the socioeconomic factors that influence food selection in health and disease are important components in epidemiological research and various clinical trials using epidemiological tools. Studies by NIH have unveiled many important relationships between diet and cancer, and between diet and cardiovascular disease. This research has also resulted in improved methods for assessing food intake and factors that influence food selection. In FY 1981, NIH provided $21,569,000 or 15 percent of total nutrition research for projects with significant epidemiological nutrition research components. Programs include those of NCI, NHLBI, NIADDK, NIAID, NICHD, NIEHS, NIA, and DRR.

The various NIH projects in epidemiology can be grouped in five basic categories: 1) evaluation of nutritional epidemiological procedures; 2) studies of early nutrition on physical and psychological development in defined populations; 3) nutrition-related epidemiological studies on maturation and reproductive function; 4) nutrition surveys of target or special population groups; and 5) epidemiological correlations of food intake to disease states.

Many epidemiological studies in nutrition are concerned with the effect of early nutrition on physical and psychological development and with maturation and reproductive function. Research is being done in the following areas: the clinical correlates of vitamin D status in infants; the increased risk of infant botulism in iron supplemented formula-fed infants versus breast-fed infants; the influence of diet on the age at which children reach menarche; the effects of protein calorie malnutrition on physical activity, cognitive development, behavior, and immunological competence of children; the effects of iron deficiency on cognitive development and on hematological parameters; the development of obesity in children, and the effect of television food commercials on children's eating habits. Studies of pregnant and lactating women are investigating the range of plasma lead concentration in pregnant women and in their cord blood, and the trends in breast and bottle feeding among various groups of women in the United States and abroad.

Epidemiological surveys of target or special population groups are conducted in order to determine the underlying reason for major differences in patterns of cancer incidence that characterize certain groups, such as migrating populations, Mormons and Seventh Day Adventists. Studies that attempt to determine epidemiological correlations of food intake to cancer incidence are looking at the possible relationships among: fat intake, steroid hormone metabolism and breast cancer; dietary fiber and colon cancer; vegetarianism and colon cancer; the use of saccharin, caffeine, tobacco, exposure to bracken fern, and bladder cancer; cancer formation as well as the quantitative use of beer, wine, hard liquors, and tobacco, and lifestyle; cancer formation and high cholesterol levels, high levels of vitamin A, and tobacco use; and the quality of drinking water and colon cancer.

The latter study is comparing a matched population of living colon cancer patients with hospital controls for differences in the quality of drinking water and other environmental factors. Water quality indices have been constructed for the past 20 and 30 years in order to account for latency. The sample size and methodology are specific enough to detect even small differences in the population's cancer risk. A substudy will determine whether the patient's past diet is a confounding factor. Data from this research will provide some insight on the importance of waterborne carcinogens in the etiology of a known cancer site. An important epidemiological tool being developed is a statistical model to analyze geographical variations in mortality rates for different types of cancer.

A portion of the support in this special interest area is concerned with processing dietary information from large scale studies of persons at risk for coronary and vascular diseases. Two cohort studies, the Honolulu Heart Study and the Puerto Rico Study, assess the dietary habits and cardiovascular disease (CVD) risk factors in their respective populations which have been verified as having a low evidence of CVD. The data from these populations are then compared with data from populations in the U.S. known to have a high incidence of cardiovascular disease.

The Framingham Heart Study also investigates the role of diet on lipid and lipoprotein levels. Data from the Puerto Rico, Honolulu and Framingham studies indicate an inverse relationship between baseline intake of total calories, primarily complex carbohydrates, and alcohol and the incidence of coronary heart disease. Such findings indicate that nutrients other than dietary lipids need to be studied in more detail.

An interesting finding related to cancer mortality resulted from the analysis of the Honolulu Heart Study data of coronary heart disease and stroke of 8,000 men of Japanese ancestry living in Oahu; the data have shown an inverse relationship between mortality in men from colon cancer and their baseline serum cholesterol levels. It is emphasized that these data are for people whose serum cholesterol is naturally low. Since diet usually lowers cholesterol concentrations by only 10 to 15 percent, those with elevated levels of cholesterol are unlikely to lower cholesterol to the range associated with cancer. Further work is needed in this area.

The Lipid Research Clinics Prevalence Study's data on lipid/lipoprotein distributions in ten North American centers compare the prevalence of high lipid and lipoprotein levels in various age, race, ethnic, and social groups. Prevalence data from the international Lipid Research Clinics in Israel show ethnic differences in lipids, lipoproteins and nutritional patterns, as well as in anthropometric and other biochemical measurements; these differences are potentially important and are being explored in depth. In Yugoslavia, the relationship of alcohol consumption and coronary heart disease is being investigated.

Other epidemiological studies concerned with the role of nutrition and dietary intake in disease states and conditions are investigating the relationship of diabetes and obesity in American Indians, the incidence of diabetes in Yemenites immigrating to Israel, the correlation of food intake to the development of gallstones, the genetic determinants of obesity and thinness, obesity and overweight as possible independent risk factors for certain diseases such as cardiovascular disease, the effects of nutrient specific undernutrition (e.g., iron deficiency and zinc deficiency), as well as protein calorie malnutrition.

A number of clinical trials are involved in the study of nutritional requirements, and appropriate treatment in selected patient populations. For example, various types of nutrition intervention strategies are being assessed in children with phenylketonuria, zinc deficiency, galactosemia, and cystinosis. Other projects are investigating the efficacy of education and other behavioral modification in children and adolescents with obesity.

Nutrition and Obesity

Obesity is a major health problem in the U.S., affecting both children and adults. Data from the NHANES I survey show that overweight affects a significant proportion of our population; 14 percent of the men and 24 percent of the women between ages of 20-74 years were found to be 20 percent or more above their desirable weight. One of every three women past the age of 55 is overweight. Obesity is associated with hypertension, hyperlipidemia and hypercholesterolemia, diabetes, and osteoarthritis, and contributes to increased postsurgical infections and complications of pregnancy. It has recently been shown to be an independent risk factor for cardiovascular disease. Consequently, research on the biomedical and behavioral aspects of obesity is an important area of consideration at the NIH. In FY 1981, a total of $16,713,000, or 11 percent of total NIH nutrition research, was spent on studies of the etiology, treatment and prevention of this condition. NCI, NHLBI, NIADDK, NINCDS, NICHD, NIA, and DRR supported research in this special interest area.

Both clinical and basic research is attempting to discover the causes of obesity, to define the types of obesity, and to establish better methods of prevention and treatment. Studies of the developmental aspects of obesity, its natural history, and its heterogeneous origins attempt to identify determinants of obesity in childhood and in adolescence. Results from this kind of research may contribute to the identification of those individuals at high risk of becoming obese later in life and allow for appropriate prevention strategies to begin before the onset of the condition. Preliminary results from a study of fat cell growth in 250 infants show that fat cells increase in size during the first 6 months of life, followed by hyperplasia until age 4 years. Hyperplasia is the increase in the size of the fat tissue due to an increase in the number of cells; in man, it is the morphological basis for the intractibility of obesity as fat cells once formed persist indefinitely.

Under the auspices of a consortium grant, seven longitudinal studies are assessing the natural history of obesity in 2,500 individuals between the ages of adolescence through the fifth decade. The data indicate that obese infants do not become necessarily obese adults; an obese child at age 4, however, is quite likely to become an obese adult. It appears that children who are overweight at 7 years of age have a 40 percent greater chance of being overweight at 30 years of age. Triceps skinfold measurements appeared to be the best single indicator of percent body fat, and the ratio of body fat to height appeared to be the best indicator of total body fat.

In order to develop a classification of obese states, a workshop is planned to try to define methods to differentiate obese subjects into specific types useful for therapeutic and preventive intervention studies.

Due to the serious health implications of this multifactorial condition, much of the research in nutrition and obesity also attempts to uncover successful treatment methods that prevent its reoccurrence. Studies have shown that behavior modification may be the most effective form of therapy for managing childhood obesity, especially if both the parent and child adhere to behaviorally oriented programs. During a 6-month period following family instruction in behavioral techniques, all children achieved a continuous weight loss and maintained the new lower relative weights over 1 year. Only 30 percent of the children receiving therapy alone maintained the lower weight over the same time period of 1 year.

Studies in adolescents are examining the relationship of nitrogen and glucose metabolism, and are attempting to clarify the optimum energy source for hypocaloric dietary therapy. Low calorie, high protein, carbohydrate free diets have been shown to produce undesirable side effects; endurance is markedly reduced, muscle glycogen is not spared, and visceral proteins are reduced. Individuals ingesting small amounts of carbohydrate did not show these side effects. Preliminary findings from stable isotope studies also carried out in obese adolescents indicate that low calorie diets containing protein and carbohydrate maintain nitrogen balance and spare lean body mass much better than do isocaloric diets consisting of protein and fat. Hypocaloric diets of protein alone do not spare body nitrogen better than an equicaloric mixture of protein and carbohydrates. In the markedly obese diabetic individual on a low calorie diet, nitrogen retention is significantly better if the diet contains carbohydrate.

In another study, conventional fats in the diets of obese patients were successfully replaced with sucrose polyester, a synthetic, nonabsorbable fat that looks, tastes, and smells like a conventional fat. It has no calories and lowers the total and LDL plasma cholesterol levels.

Other studies of obesity treatment are also under way at St. Luke's Hospital Obesity Center where the palatability of different diets modified to contain less energy is being examined. It appears that individuals eat fewer calories when a highly palatable diet is modified to contain less energy, suggesting that low calorie analogs are effective in promoting weight loss. Added fiber to certain foods has also been shown to be effective in reducing calorie intake and in subsequent weight loss. In other research under way at St. Luke's, voluntary food consumption was found to be closely related to the number and size of fat cells in individuals.

Basic research in the area of obesity includes studies on the central nervous system regulation of fuel mobilization and storage; regulation of fat cell size, fat metabolism, and growth of adipose tissue; the effect of meal pattern and diet on energy metabolism; the effect of exercise on lipid metabolism, etc.

The working hypothesis of obesity which holds that hypothalamic pituitary dysfunction and altered neuroendocrine secretions cause decreased thermogenesis and/or increased food intake is under investigation. Research has also shown differential hyperplasia in hyperphagic rats (ventromedial hypothalamus lesioned), with equivalent gains in weight, due to differences in the composition of the diet. Rats fed a milk diet had an increased number of adipocytes than the chow-fed controls, and high fat diets induced adipocyte hypertrophy in all fat depots and hyperplasia in only some. Starved rats or rats exposed to the cold had smaller fat cells, but no reduction in the number of cells. Animals whose diets were restricted in early life had fewer fat cells and less total body fat. These characteristics were sustained in later life when food intake was no longer restricted.

In order to better understand the relationship of obesity and the phenomenon of insulin resistance as adipocytes increase in size, studies on insulin receptor proteins embedded in fat cell membranes are under way. Exposure to trypsin appears to increase the fat cell receptor's affinity for insulin. Fat cell storage, therefore, may ultimately be controlled pharmacologically, by interfering with the ability of the insulin receptor complex to trigger lipogenesis.

The study of obesity, aging and their interactions is also under way through a rat model that separates the effects of obesity from those of aging. An automated food dispenser capable of preselecting quantities of food at predetermined intervals controls the degree of obesity since gorging alters gastric capacity, rates of absorption of food, plasma insulin levels and tissue metabolic activities. In a preliminary study, increasing daily caloric restriction caused a progressive limitation of body weight gain and of adipocyte enlargement in rats from 3 to 7 months old. Insulin binding by the adipocytes was significantly increased in the animals with the most severe food deprivation (40 percent of ad libitum), but it did not differ in adipocytes from groups fed 100, 80, or 60 percent of the ad libitum ration. It appears that a critical degree (40 percent) of chronic food deprivation may be needed to produce a significant increase in insulin binding. Another investigator is looking at the effect of exercise, particularly running vs. aging, on insulin resistance of fat cells in Long-Evans rats.

Studies of brown fat cells are helping to clarify the relationship of diet, exercise, environment and norepinehprine stimulating drugs on thermogenesis and the control of obesity. Brown adipose tissue (BAT) is very rich in mitochondria and appears to burn fat producing free heat rather than bound energy as adenosine triphosphate. One investigator found that a low protein, high carbohydrate diet promoted hypertrophy of brown adipose tissue, while dietary fat had no effect. Force feeding was found to increase free energy production in BAT. Exposure to the cold also seems to markedly increase brown fat, as hibernating animals have greater stores than nonhibernating animals. Norepinephrine was found to stimulate thermogenesis in brown adipose tissue. Thus, brown fat cells may be important sites of free energy loss in the nonobese.

The relationship of obesity to disease states such as diabetes, cancer, coronary heart disease, stroke and hypertension is an important research area. Studies are looking at the possible causes of obesity and diabetes in Oklahoma Indians, as well as obesity and diabetes in pregnancy.

In terms of obesity and cancer, research is under way on the effects of high and low fat diets, reduced calorie intake, and hypothalamic induced obesity on serum hormone levels and the subsequent development and growth of breast tumors.

The overall objective of this research is to determine the relation of the brain, particularly the hypothalamus, to the development and growth of mammary and pituitary tumors and to utilize this information to inhibit such development and growth. Neuroendocrine mechanisms whereby pregnancy and lactation influence mammary tumor growth are also being investigated.

Studies are also investigating the role of diet in prostate cancer; one such study is under way to examine the dietary heterogeneity of Hawaii's multiethnic population. This case control study is investigating the role of fats, cadmium/zinc, and vitamin A.

Numerous animal and human studies under way to examine the relationship between diet and colon cancer seek to identify carcinogens and cocarcinogens present in the lumen, the relationship of bile acids and their metabolites in cancer etiology, the nutritional factors that contribute to high cancer incidence, and the fecal enzymes that may play a role in cancer etiology.

Studies continue on the relationship of obesity and coronary heart disease, stroke and hypertension. Recent data from the Framingham Heart Study indicate that the results of the multiple logistic regression analyses show that Metropolitan Relative Weight (MRW), on initial exam, was related to the differences in the 26-year incidence of coronary disease in men independently of age, cholesterol, systolic pressure, cigarette smoking, left ventricular hypertrophy and glucose intolerance.* Increasing relative weight in women was found to be associated with increasing coronary disease, stroke, congestive failure, and coronary and cardiovascular death. The results indicate the importance of obesity as an independent long-term predictor of cardiovascular disease. It has been calculated that there is a 2 percent increase in the risk of CVD or death due to CVD in 26 years for every additional pound of weight.

Nutrition and Genetics

Biochemical genetics has advanced our understanding of the interactions between heredity and nutrition, of the development and treatment of certain diseases, and of normal development and disease prevention. Research on the effects of nutrition and dietary intervention on inherited diseases and conditions is supported by the NCI, NHLBI, NIADDK, NINCDS, NICHD, NEI, NIEHS, and DRR for a total of $39,391,000 or 27 percent of the total nutrition expenditures.

Research on genetics and nutrition include studies on inborn errors of metabolism; metabolic differences in nutrient requirements; chromosomal aberrations and determinations of cellular function, especially DNA repair mechanisms; the role of dietary control of diabetes, hyperlipoproteinemia, obesity, anemia and iron storage diseases, etc.

A number of projects involve nutritional, biochemical and metabolic aspects of a number of inborn errors of metabolism including phenylketonuria, galactosemia, maple syrup urine disease, urea cycle enzyme deficiencies (isovaleric acidemia, hyperglycinemia, hyperargininemia, citrullinemia, methyl malonic aciduria, hyperornithemia), genetic disorders of pyruvate metabolism (pyruvate carboxylase deficiency, glucose-6-phosphatase deficiency), cystinosis, and Menke's kinky hair syndrome.

Various dietary manipulations can overcome or bypass enzymatic defects that characterize inborn errors of metabolism. For example, elimination diets can prevent the accumulation of nutrient substrates in metabolic pathways prior to the enzymatic defect. Galactose is eliminated from the diets of persons with galactosemia, branched chain amino acids from those with maple syrup urine disease, phenylalanine from those with phenylketonuria, and nonessential amino acids from those with urea cycle enzymopathies (inborn errors that occur once in every 30,000 births).

Two conceptual breakthroughs have occurred in the dietary management of urea cycle enzymopathies. Investigators have recently shown a steady improvement in persons deficient in arginase, inherited as autosomal recessive, when given a semisynthetic diet with N equivalents of 0.6g/kg/day for the treatment of hyperargininemia. Using the keto-acid analogs in place of the essential amino acids appears successful in the dietary management of these conditions; for example, d-ketoisocaproic acid replaces leucine as part of a low protein diet. In addition, experiments are under way on alternative metabolic pathways for the excretion of excess ammonia and other nitrogen metabolites. Hippuric acid, phenylacetylglutamine, arginine, citrulline and arginosuccinic acid may serve as possible endpoint alternatives to urea in nitrogen metabolism.

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*The midpoint of the desirable weight range for medium build (Metropolitan Life 1959) was chosen as the reference weight for a given height. The MRW was computed for each subject by forming the ratio of his or her body weight to the reference weight for the particular height. This ratio is expressed as a whole number in percent.

Phenylketonuria, a disorder that occurs approximately in 1 out of 14,000 births and requires a low phenylalanine dietary regimen, has received much research attention. Biochemical, behavioral and anthropometric studies of 150 children enrolled in the collaborative study of children treated for PKU are under way to determine the appropriate age of a child at which a normal diet can replace a low phenylalanine diet without affecting cognitive development. Children at age 6 are randomly assigned to either a low phenylalanine or control group. These children are then compared for the next 3 years in terms of their intellectual and perceptual skills. Also under study are hyperphenylaninemia and the pathogenesis of caprine oligosaccharide disorder, a newly identified inherited neurological disease.

Maternal PKU presents serious problems to both mother and child as it appears to impair fetal development causing microcephaly, mental retardation, low birth weight, and congenital cardiac malformations. A low phenylalanine diet given to the mothers has not been shown effective in preventing the mental retardation in offspring that results proportionate to the level of maternal hyperphenylalaninemia. Three animal studies, one in rhesus monkeys and two in rats, are also under way to investigate the parameters of pregnancy and PKU.

In the management of PKU in infants, use of twice the normal levels of dietary leucine, isoleucine and valine in addition to restricting phenylalanine is under investigation. Data indicate that treatment with these branched chain amino acids decreases the ratio of cerebrospinal fluid phenylalanine to serum phenylalanine by interfering with the transport of phenylalanine across the blood-brain barrier.

Another method of ameliorating PKU, as well as other inborn errors of metabolism, is by adding increased amounts of the essential metabolites that lie in pathways beyond the deficient enzymatic reaction. In the case of PKU and the absence or deficiency of phenylalanine hydroxylase, the enzyme needed for the conversion of phenylalanine to tyrosine, it appears that providing sufficient tyrosine helps to promote normal growth and development. Tyrosine is needed for the synthesis of thyroxine, melanin and catecholamines, as well as for protein synthesis.

A rare variant form of PKU results from a deficiency of dihydropteridine reductase (DHPR), an enzyme needed to provide reduced biopterin cofactor needed not only for the conversion of phenylalanine to tyrosine but for the conversion of tyrosine to dihydroxyphenylalanine (DOPA) and of tryptophan to 5-hydroxytryptophan. Scientists have succeeded in treating this variant form of PKU with dietary biopterin supplements as well as with 5-hydroxytryptophan, dehydroxyphenylalanine and tetrahydrobiopterin.

Much remains to be learned about the genes of PKU and the pathogenesis of the condition, but it is certain that dietary restriction of phenylalanine greatly improves the outcome.

In the treatment of glycogen storage diseases (GSD) supplying increased levels of metabolites beyond the enzymatic block, i.e., glucose, has been shown to reduce the rate of glycine turnover--less glycine is needed for gluconeogenesis. This therapy is aimed at preventing the growth failure of GSD that is caused by protein degradation in a futile effort to synthesize glucose.

Gyrate atrophy of the retina and choroid is an inherited disease which is characterized by reduced retinal function, myopia, constricted visual fields, increased dark adaptation, and atrophy of the retina and choroid. In an exciting example of laboratory and clinical collaboration, this condition was shown to be characterized by elevated levels of ornithine in the blood due to a deficiency in an enzyme that normally metabolizes this amino acid, and a special diet was developed that has been shown to improve visual acuity significantly.

Another inherited metabolic disturbance which appears to be successfully treated by nutritional therapy is favism, or sensitivity to fava beans that results in the hemolysis of older rather than younger red blood cells. Sensitive individuals have a deficiency of glucose-6-phosphate dehydrogenase in their blood and a reduction in glutathione blood levels. Scientists have recently found that high doses of vitamin E shift the intracellular redox potential enough to ameliorate the oxidative environment caused by the deficiency of reduced glutathione, which is caused by a deficiency in NADPH. The antioxidant nutritional therapy with vitamin E therefore may be helpful in the treatment of millions of people living in the Mediterranian basin or in the malarial belts of Africa and Asia who suffer from chronic hemolytic anemia.

Scientists have also reversed the susceptibility to oxidative damage in patients with glutathione peroxidase synthase deficiency by treating them with large doses of vitamin E. This recent success demonstrates how research on a relatively common genetic disorder like glucose-6-phosphate dehydrogenase can be extended to a relatively rare genetic disorder such as disorders of glutathione metabolism.

Other vitamins which have shown to be effective in the treatment of genetic disorders include vitamin B_6 (pyridoxine) and biotin. In some seizure disorders and in homocystinuria, large quantities of pyridoxine appear effective in overcoming a decreased affinity of the apoenzymes (glutamate decarboxylase and cystathione synthetase, respectively) for their vitamin B_6 cofactor. Similarly, large quantities of dietary biotin can be used to overcome propionyl-CoA-carboxylase deficiency and 3 methylcrotonyl-CoA-carboxylase deficiency. Research has shown that treating patients having multiple carboxylase deficiency with large amounts of biotin has resulted in complete clinical recovery.

Differences in individual requirements for dietary essential nutrients may be due in part to genetic variations that affect metabolic pathways and thereby the ability to utilize ingested nutrients. Thus, several research projects are aimed at achieving a better understanding of the metabolic role of diet in the causation, prevention and treatment of genetic diseases and conditions. Additional research is under way on iron storage disease and Cooley's anemia (thalassemia major); genetic factors in obesity and diabetes; familial zinc binding protein in hyperzincemia; inherited disorders of pigmentation; inherited metabolic and nutritional causes of arthritis; the familial aggregation of inflamed bowel disease; amino acid metabolism; and inherited abnormalities of iron metabolism and and copper metabolism, such as Menke's kinky hair syndrome.

A study is under way on Menke's kinky hair syndrome, a condition of early infancy characterized by a generalized abnormality of copper metabolism that leads to developmental regression, seizures, temperature instability, progressive cerebral degeneration and usually death before 3 years. The copper content of blood, liver and perhaps brain is diminished in patients with the syndrome and decreased activity of cuproenzymes such as cytochrome oxidase, connective tissue amine oxidase, copamine B-hydroxylase and tyrosinase is presumed to underlie many of these abnormalities. This research aims to clarify the role of metallothionine and copper chelation in copper metabolism in order to identify an effective prenatal treatment.

Another study seeks to identify hereditary disorders of the metabolism of amino acids, organic acids, and related compounds, especially those causing mental retardation and other neurological and metabolic abnormalities.

In animal studies, the analysis of the influence of combined genetic and nutritional factors on drug teratogenicity continues to improve our understanding of the interactions between genetic and nutritional factors in mammalian development. For example, increasing levels of dietary zinc from 9 ppm to 1,000 ppm in one strain of mice (CBA) was found to reduce acetazolamide induced fetal malformations and resorption from 65 to 42 percent. Another study of the interactions of genetic and nutritional factors is investigating health and longevity in two strains of mice--one short-lived and the other long-lived. In the short-lived strain, food restriction appears to increase survival time largely due to a decreased incidence of breast cancer and increased age at which tumors are first detected. In the long-lived strain, food restriction appeared to have no effect on mortality that could be detected at the time when 30 percent of the mice had died. Any differences which may appear later in the survival curve will be identified as the study continues.

Investigations to assess the mutagenicity of natural products as environmental contaminants in foods and foodstuffs are under way in vivo and in vitro in order to determine the specific mechanisms by which the mutagenic agents effect biological change. Associations between mutagenicity and carcinogenicity comprise a significant part of this effort.

Other studies on genetics, nutrition and carcinogenesis include: in vivo and in vitro investigations of the genetic regulation of aflatoxin metabolism and the specific mechanisms involved in its relationship to small and large bowel carcinomas; the role of hormones in relation to genetic, viral, chemical, and nutritional factors in the development of mammary tumors; research to examine the ontogenetic expression of specific metabolites in human lymphocytes in an effort to elucidate patterns of enzyme activities in children with acute leukemia; research to characterize viral specific macromolecular events which accompany a viral induced malignancy; and studies on the specific genetic control of replication by in vitro manipulation of amino acids known to control different stages of the cell cycle.

In an attempt to identify individuals at risk for cancer before the clinical symptoms become manifest, one study is looking at families with hereditary site specific colon cancer in order to uncover any markers specific for a cancer prone genotype. Recognition of such markers have important implications for identifying high risk patients in the general asymptomatic population.

In the area of coronary heart disease and familial lipid patterns, much of the data from the Puerto Rico and Framingham studies, Yugoslavia Heart Study, the Lipid Research Clinics Population Studies, and the Honolulu Heart Study add to the knowledge of the interaction of genetics and nutrition. The Honolulu Heart Study for example, is a long-term prospective study of coronary heart disease and stroke in 8,000 men of Japanese ancestry living in Oahu. The study is attempting to determine which risk factors might explain the differences in the risk for coronary heart disease in a population undergoing Westernization in diet and other lifestyle factors.

Total Parenteral and Enteral Nutrition

Research in the area of total parenteral and enteral nutrition encompasses investigations which probe and manipulate host metabolism and physiology in an attempt to manage successfully the nutritional support of the patient. In FY 1981 research support in this area totaled $11,591,000 or 8 percent of total nutrition research expenditures. Research was funded by NCI, NIADDK, NIAID, NIGMS, NICHD and DRR in this area.

Studies of the methodology to define precisely the nutritional status of patients and to determine their nutritional requirements are carried out in low birth weight infants, in children and adults with cancer, trauma and burns, or who have undergone surgery. Research in premature infants continues to provide insight on the parenteral requirements for amino acids, and on nitrogen retention.

In addition to research on the nutrient composition of TPN fluids, studies are also examining the roles of certain nutrients delivered parenterally in infant development. One study is looking at the effects of parenterally administered vitamin E on preventing or modifying the course of bronchopulmonary dyplasia in infants. Related work addresses the metabolism of intravenously administered lipid emulsions in infants, bile salt metabolism in infants on TPN, the effect of cysteine and taurine in TPN solution given to infants, and newborn hyperglycemia induced by parenteral therapy.

One study to determine the contribution of endogenous glucose production to neonatal hyperglycemia has shown that very low birth weight infants produce their own glucose even during constant glucose infusions. Another study is looking at various metabolic markers, such as 3 methylhistidine, in the urine of diseased neonates in order to establish the required rate of administering parenteral nutritional support.

From studies on amino acid and nitrogen balance investigators have reported a new approach to estimating human essential amino acid requirements which is simpler than nitrogen balance and can be applied to patients on parenteral or enteral nutrition without disturbing their clinical care. The method is based on changes of expired $_{13}CO_2$ during tracer infusion of $_{13}C$ labeled amino acids. Additional studies of protein status and nitrogen balance are testing whether lipids substituted for carbohydrate in a complete intravenous diet of lipid, glucose and protein influence nitrogen balance.

Studies of the nutritional support of patients, especially those with trauma and burns, have examined the beneficial effects of various protein supplements. The optimal metabolic management of trauma and burn patients is particularly important to patient survival. These patients have altered glucose metabolism, and a sustained hypermetabolism and negative nitrogen balance that precipitates weight loss. Investigators have found that the increased glucose levels observed following trauma are related to the severity of the injury and not the result of insulin deficiency. Research continues on the underlying mechanisms causing these changes and on the nutritional support necessary to sustain life in these patients.

One study carried out in children with severe burns suggests that protein supplements, given intravenously, enhance the children's nutritional status, immune function, and resistance to sepsis. In metabolic studies of diabetes, portal systemic encephalopathy, and renal disease, leucine and its keto acid analogue alpha-keto-isocaproic acid appear essential to protein synthesis and protein turnover in muscle. It appears that many of the branched chain amino acids serve as biochemical regulators and precursors in a number of complex metabolic reactions. These reactions include not only the regulation of protein turnover in muscle, but also cholesterol synthesis, gluconeogenesis, insulin secretion and urea formation.

Recent findings indicate that the regulation of branched chain amino acid enzymes, particularly the dehydrogenases, appears to be under the influence of a phosphorylation dephosphorylation mechanism. One enzyme that has been identified and characterized is isovaleryl-CoA-dehydrogenase. The branched chain keto acid dehydrogenases have been shown to be inhibited by fatty acids and stimulated by carnitine and insulin. Also documented is the branched chain amino acid or keto acid oxidation inhibition on hepatic urea synthesis and gluconeogenesis, and its stimulation of insulin secretion from pancreatic beta cells.

The nutritional support of cancer patients is an important area of research which tests the hypothesis that the administration of TPN is more effective than normal hospital regimens in maintaining adequate nutritional status and that it does not adversely affect tumor control. A number of clinical studies as well as animal studies attempt to assess the effectiveness of TPN in maintaining the immune response and thereby lessening or moderating the complications associated with cancer treatment.

One study is examining the effect of TPN during chemotherapy on tumor response and patient survival in patients with advanced small cell anaplastic carcinoma of the lung. It seeks to determine the potential of TPN to improve the clinical response to treatment and improve patient survival.

Other projects are testing the hypothesis that a tumor induced amino acid imbalance is responsible for some of the tumor's effects on a host. Another study is specifically concerned with glucose and lactate metabolism in metastatic and colorectal cancer patients receiving short-term intravenous hyperalimentation. This study seeks to determine if lactate production is related to tumor growth.

A study in rodents is examining the TPN administration of variable amounts of glucose in those animals with and without a transplanted tumor. The study is designed to show whether the metabolism of the host is altered to meet the needs of the growing tumor.

In addition, prospective trials of the use of TPN as an adjunct to radiation, surgery and aggressive chemotherapy are under way. One study is evaluating the benefits and complications of nutritional support to children receiving multimoded treatment for stages II-IV Wilms' tumor.

Nutritional support of surgical patients must account for nitrogen turnover and other specific metabolic needs in order to assist the body to repair itself properly. TPN studies under way in surgical patients include the effect of various TPN mixtures on nitrogen turnover, and albumin synthesis; fat mobilization and protein sparing therapy; methods to detect and treat essential fatty acid deficiency; and the intravenous requirements for micronutrients.

Research in this special interest area under way at the Clinical Nutrition Research Units also considers nutritional support of the cancer patient; e.g., the effects of TPN, particularly micronutrient metabolism, are being examined in patients with lung cancer. Other studies examine the micronutrient metabolism of vitamins A, C, E, and pyridoxine in patients with essential fatty acid deficiency; hepatic function of those patients on TPN; and the effect of amino acid infusions on plasma amino acid patterns.

Nutrition and Aging

Research on nutrition and aging in FY 1981 was supported by NCI, NHLBI, NIADDK, NIA, and DRR in the amount of $10,236,000, or 7 percent of total nutrition research. A major question for researchers today is whether nutritional needs change significantly beyond the middle decades of life and, if so, how these needs change and what specific nutrients are involved. Both laboratory and clinical studies examine the effect of aging on: requirements for specific nutrients, nutrient absorption, and metabolism; the role of nutrients in changes in bone density, fat metabolism and atherosclerosis, and biochemical changes in the brain; taste acuity and dietary intake.

A number of animal studies are under way to look at various phenomenon related to aging and nutritional parameters. One hypothesis under investigation is the increased longevity seen in rodents with food restriction. The growth retardation that accompanies food restriction can be interpreted as a prolonged retention of growth potential which in some way may retard the aging process. Another study indicates growth retardation, maturational delay, and increased longevity in rats fed a tryptophan deficient diet from the time of weaning. The tryptophan deficient rats, as well as rats given serotonin blockers, appeared to have a profound reduction in brain serotonin levels, but these reductions could not in all cases be causally correlated with the delay in growth and development. Other tryptophan dependent processes are now under study for a possible causal relationship to the observed growth retardation.

Functional deterioration with aging is also under study with specific research aimed at age-related structural and functional changes in the small intestine in rats. The intestine of older animals appears to undergo crypt cell hyperplasia not seen in younger animals. This hyperplasia, however, is not accompanied by an increased turnover of epithelial cells which is present in intestinal disease states with hyperplasia. The age-related change in cell generation appears to be accompanied by a delayed differentiation of epithelial cells migrating onto the villus. Another study of functional deterioration is investigating two possible mechanisms underlying the decline in glucose tolerance that appears with age.

Additional animal investigations on the role of nutrition and aging are planned for the regional primate research center which is a colony of 72 aged nonhuman primates. A 5-year study will attempt to assess how nutrition, specifically the U.S. human diet, and normal biological aging processes may interact to produce the physiological and behavioral changes, and diseases common in the elderly. Four groups of young to aged adult primates will be studied; half of each of the four groups will be fed semipurifed diets consistent with the U.S. diet while the other half will receive a diet consisting of less fat, cholesterol, sugar, and salt. Periodic examinations will provide information on 48 standard biological and clinical characteristics and four measures of biological aging. The studies are designed to clarify the effects of biological aging and diet on carbohydrate and fat metabolism, psychological functions, pharmacodynamics, genetic assurance mechanisms, and several specific disease processes, such as involutional maculopathies, periodontal disease, ankylosing hyperostosis, and preneoplastic mammary dysplasia. At the end of the 5-year study, specimens will be examined by a large number of investigators for additional study to determine whether the findings have any particular relevance to human aging.

The prevention of diseases such as cancer, diabetes, atherosclerosis, coronary heart disease. stroke, hypertension, and blindness are more of a problem as people age. Since the incidence of tumors observed in old age is very high, the following metabolic parameters that might contribute to this phenomenon are being studied in experimental animals; age-related changes in body weight and body composition, efficiency of energy utilization, and maintenance requirements. Research is also under way to define the interaction of vitamin A and its synthetic derivatives with preneoplastic and neoplastic states; to assess the influence of gradual adult initiated controlled dietary restriction on spontaneous carcinogenesis; and to evaluate several age sensitive immune mechanisms.

The development of atherosclerosis, coronary heart disease, stroke and hypertension with age are common concerns in geriatric research both in the United States and abroad. One study is looking at blood levels of hormones present in Japanese and American women at different times of the day and month in order to assess circadian or ultradian rhythms. These hormone levels are being considered in terms of their possible relationship to food consumption patterns, menstruation, sleep cycles, heartbeat and blood pressure.

Other research directly related to the health prolems of older adults is investigating the effect of lifestyle on bone densities; bone density and the development of osteoporosis; the effect of aging on sulfur amino acid metabolism; maturity onset or noninsulin dependent diabetes; and obesity.

In addition, one Clinical Nutrition Research Unit contains a specific geriatrics program component that provides training for professional students in the field of geriatrics, as well as nutritional support services for the geriatric patient.

Maternal Nutrition

It is now an accepted tenet that the nutritional status of the mother affects not only the growth and development of the child, but her own health as well. Many of the nutritional questions, however, remain unanswered and the problems remain to be solved. In FY 1981, NIH research with emphasis on maternal nutrition totalled $7,663,000, or 5 percent of the total nutrition expenditures. Institutes participating in maternal nutrition research were NHLBI, NIDR, NIADDK, NINCDS, NIAID, NICHD, and NIA, as well as DRR.

Research in this area includes studies on: the relationship of maternal nutritional status to reproductive function; nutritional requirements of women during pregnancy and lactation; the relationship of maternal nutrient intake to fetal outcome and subsequent infant growth and development; placental transport of nutrients from maternal to fetal circulation; the causes and potential nutritional therapy for intrauterine growth retardation; and the various components of human milk.

A number of longitudinal studies in human populations are under way to investigate the relationship of maternal nutrient intake, maternal nutritional status and the subsequent infant growth and development. Recent data from these studies, reviewed in the American Journal of Clincial Nutrition (Vol 34: April Supplement 1981), indicate that 75,000 Kcal is the total number of excess kilocalories required to support a pregnancy to term. This amounts to an extra 300 Kcal/day above prepregnancy energy intake. The requirement for augmented protein intake during pregnancy remains less clear. Studies in both humans and in nonhuman primate models indicate a surprising lack of effect of diminished protein intake during pregnancy on fetal outcome and subsequent infant growth and development.

The means by which nutrients pass from the mother and her fetus are complex. Thus, research focuses on efforts to predict the nutritional status of the fetus through the examination of various factors in the mother's blood; on the elucidation of the mechanisms of placental transfer by which glucose, amino acids, vitamins, zinc, calcium and other essential nutrients are transported in proper amounts from mother to fetus; and on the effects of excessive or deficient amounts of certain nutrients on the morphology and endocrine development of the fetus.

One study has found a rapid and efficient placental transport system for retinol from ewe to fetal lamb. The possibility of a significant fetal-to-maternal passage of retinol is now being examined in an effort to account for an apparent increased rate of retinol metabolism in the fetus than in the mother. Prior to this study differences in retinol metabolism between mother and fetus had not been detected.

In other studies, scientists have found genotypic exigencies that dictate fetal demands for certain nutrients, e.g., copper, manganese, pyridoxine, biotin, far exceed the ability of the maternal-placental circulation to supply them. It appears that deleterious fetal development can be avoided if the nutritional demands of such aberrant genotypes are met by augmenting the maternal diet with specific nutrients.

One study of successful fetal nutritional therapy was carried out in a fetus with biotin responsive multiple carboxylase deficiency by providing the mother with 10 mg/day of oral biotin during the last 4 weeks of pregnancy. Thus, nutritional therapy during fetal life is useful in the treatment of certain inborn errors of metabolism and other kinds of extreme nutrient dependency.

In related research of efficient placenta transport of nutrients, investigators have shown that late in gestation, the placenta must supply the fetus with 20-25 mmole/kg/day of amino acids and 40 mmoles/kg/day of glucose. Studies are under way on the placental mechanisms responsible for the net transfer of these large quantities of nutrients; the placental transport of glucose, for instance, appears to be independent of maternal plasma insulin levels. The placental insulin receptors, although abundant, do not appear to be involved in this transport, but may serve some purpose in placental energy metabolism.

Research emphasis is also placed on fetal development in nutritionally or metabolically compromised pregnancies as well as on elucidating predictors of intrauterine growth retardation (IUGR). The etiology of IUGR appears to be multifactorial in nature involving not only maternal nutritional status and maternal nutrient intake during pregnancy, but also placental circulation and nutrient transfer, maternal smoking habits and socioeconomic status, and perhaps maternal-fetal immunological incompatibility. Maternal factors shown to be strong predictors of IUGR are low prepregnancy weight, non-narcotic drug abuse, and persistent low serum estriol levels during pregnancy. Studies in the ovine animal model indicate that nutritional supplementation provided directly into the fetal stomach may prevent IUGR. Results of this research may pave the way for the testing of intrauterine nutritional therapy in humans.

Other animal studies are under way on the prenatal treatment of trace mineral metabolism disorders; hormone changes during pregnancy; and food intake during menstrual cycles and pregnancy. In a mouse model of Menke's kinky hair syndrome, copper supplementation of pregnant dams carrying the mutant strain appears successful. A primate study includes blood biochemical analyses for assessing hormone changes during pregnancy. The nutritional status of breeders at high and low risk for poor pregnancy, as well as their surviving offspring, is also being examined. Normal laboratory indices of zinc status are being determined at 1-month intervals during pregnancy and will be compared with results for women whose pregnancies are complicated by abnormalities of fetal development. Indices which are evaluated include zinc concentrations in plasma, erythrocytes, hair, saliva, urine, and diet. The indices are measured longitudinally during lactation, together with the zinc content of breast milk and the plasma and hair zinc concentration of the infants. Data will be analyzed to determine if there is any correlation between dietary zinc intake, maternal zinc status, zinc content of milk and zinc status of the breast fed infant. Another primate study is in progress at the Wisconsin Regional Primate Research Center to determine mechanisms of eating behaviors and energy expenditure. Individual differences in food intake were evaluated and found not to be significantly related to age, weight or reproductive history. However, earlier observations of systematic changes in food intake during menstrual cycles of intact females were confirmed. Maternal glucoregulation and food intake were found to be related to fetal growth and lung maturation during pregnancies of normal and experimentally diabetic animals.

Efforts are being made to learn how to manage the nutritional needs of a normal pregnancy as well as gestation complicated by hypertension and renal disease, obesity, diabetes, pica and deficiencies in nutrients such as folate or iron. One study is particularly interested in determining zinc status during a normal pregnancy as well as pregnancies complicated by abnormalities in fetal development.

International Research in Nutrition

The NIH conducts and supports a major portion of the world's biomedical research as it relates to health maintenance, human development, disease prevention and treatment. International nutrition research utilizes the specialized talents and different environments available only in studies conducted in developing countries by U.S. or foreign scientists. This research also includes studies conducted by foreign scientists working in the U.S. and other countries in the developed world. In FY 1981, NCI, NHLBI, NIADDK, NICHD, NEI, and NIEHS support for international nutrition research was $1,998,000 or 1 percent of total expenditures in nutrition research.

A number of studies currently under way are examining the impact of protein calorie malnutrition, as well as specific nutrient deficiencies on the physical and mental development of infants and children; the trends in infant feeding; and the interaction of cultural, health, and economical factors on the nutritional status of children.

Studies in malnourished Peruvian infants and children attempt to determine their physiological limits to consuming and digesting wheat, potatoes, sorghum, and oats while satisfying their protein needs. Data on the digestibility, protein content, and other factors in these possible protein sources reveal that digestibility of wheat flour is excellent but lysine is limited; digestibility of potato starch by malnourished infants is less satisfactory than that of wheat flour (potato diets produce significant carbohydrate malabsorption and do not provide adequate amounts of methionine or tryptophan); whole grain sorghum flour is poorly digested by malnourished infants; and the high biological value of protein in oats makes it a unique and excellent cereal source of protein to infants. Protein needs of infants are met when oats supply 66 percent of total calories. Since the low protein content and poor digestibility of many of the alternative vegetable protein sources are apparent, steps can now be taken to alleviate the problem of how to feed many of the world's malnourished infants by the most appropriate means. Most of the world's weaned infants and children must depend on vegetable protein sources. Results from this research clearly show that even if the energy needs of infants are met by common vegetable protein and staple foods, the protein needs are often not satisfied.

Another study on protein/calorie malnutrition (PCM) in children, under way in Guatemala, is examining serum factors responsible for the opsonization of bacteria. Deficiency of complement and of complement-mediated opsonins, known to occur in malnourished hosts, may play a role in the high incidence of fatal gram-negative septicemia in acute malnutrition. The effect of dietary therapy alone or dietary therapy plus replacement of complement in the form of fresh-frozen AB/Rh+ plasma on serum complement levels and opsonin activity is being assessed in these children with PCM. Results from the study indicate that dietary therapy with the replacement of complement in the form of fresh-frozen plasma increases functional complement activity in the serum of undernourished children. This plasma has also been shown effective in increasing complement activity in chronically ill adults suffering from protein calorie malnutrition in developed countries.

International studies are particularly useful for comparing frequencies of breast-feeding and in evaluating reasons for changes in frequency within certain populations. One study in Israel is looking at the change from exclusive breast-feeding to either exclusive bottle feeding, or a combination of breast and bottle feeding in populations in isolated, under-developed regions that are undergoing a transition from nomadic to sedentary lifestyles.

Studies on the composition of breast milk and milk intolerances continue in order to increase our knowledge of the effects of infant feeding practices on subsequent development. A study of Mexican women is comparing the composition of breast milk of mothers from Mexico City to mothers from Houston, while taking into consideration differences in diet, exposure to agricultural and industrial toxins, pathogens, and other environmental agents.

The prevalence of milk intolerance due to lactase deficiency in the Inuit Eskimos and Indians of Canada is shown to be approximately 73 and 60 percent, respectively. By ascertaining levels of vitamin D and its metabolites in Eskimo and Indian children, the investigators will relate the prevalence of milk intolerance among these groups to the effectiveness of the Canadian program of milk fortification with vitamin D. Data collection continued throughout FY 1981. Analysis of the data will begin in FY 1982.

Research is under way in Australia on various aspects of lactation and milk composition of marsupials. It has been shown that in the tammar, only the suckled gland differentiates into a lactose-producing, milk secreting organ; unsuckled glands regress to a quiescent state after parturition. The cause of a striking rise in lactose synthesis in the tammar on the second day of lactation is under investigation.

A study in Kenya is testing the hypothesis that the nutritional status of children is partially correlated with family land holdings, water supply, and farming practices. The prevalence of protein calorie malnutrition will be measured in a random sample of 60 children under 5 years of age, living in eight villages located in a mountainous area of traditional subsistence agriculturalists. Cash cropping and wage labor migration are beginning to infiltrate this area, so investigators are particularly interested in whether such changes affect nutritional status. Preliminary data indicate that children of cash cropping farmers have more protein calorie malnutrition than children of subsistence farmers. This study exemplifies how various cultural situations may act as determinants of nutritional status.

International nutrition research also encompasses studies on the primary diseases that now afflict both the developed and the developing world. Because patterns of cancer incidence can be identified with particular groups, a number of epidemiological studies are examining the possible relationship of diet and/or nutritional status on the incidence of pathogenesis and natural histories of cancer. Other investigations attempt to determine if shifts in cancer risk occur when individuals migrate to different environments.

Studies of cancer prevention include a clinical trial on the use of 13-cis-retinoic acid and on the chemoprevention of skin cancer in albinos living in Tanzania. Investigators can observe unique populations as they are affected by their natural environment and can gain valuable information and ideas appropriate for hypothesis testing. In Denmark, a case control study is investigating the relationships of various environmental factors to the risk of cancers of the lower urinary tract. Other investigations address the feasibility of developing pharmacological agents to counteract the cachexia and anorexia of cancer. International collaborative studies on the causes, treatment, and prevention of cancer will help further research approaches to cancer throughout the world.

Nutritional factors are important also in cardiovascular disease, a main focus of several international programs. Research projects of coronary and vascular disease include those under way in Canada, Puerto Rico, Israel, USSR, and Yugoslavia. Epidemiological studies under way in Lipid Research Clinics are investigating the prevalence of lipid disorders, the effect of diet on these disorders, and their relationship to cardiovascular disease. These studies are designed to generate internationally comparable information on plasma lipids and lipoproteins, cardiovascular risk factors, and demographic and nutritional status that will allow a comparison of the nature of the atherosclerosis problems. Progress in answering questions to the disease problems of atherosclerosis and hypertension is expected to be facilitated through carefully targeted international cooperative research of widely differing populations that vary in lifestyles, nutrition, and susceptibility.

A joint study on secular trends in coronary heart disease risk factors is under way with the Institute of Chronic Disease and Gerontology in Yugoslavia. Data have shown a direct association between alcohol intake and death from stroke.

Studies of the nutritional management of osteoporosis look at the possible prophylactic and therapeutic roles of the biologically active vitamin D. The effects of prolonged administration of a combination of phosphate, calcium and fluoride salts on bone structure and density are being studied in middle-aged patients with osteoporosis. Also under investigation is the incidence of diabetes among new Yemenite immigrants; the risk factors contributing to glucose intolerance; relationship of diabetes to adipose tissue development, and other factors such as genetics that contribute to obesity; the incidence of iodine deficiency and goiter; the various inborn errors of metabolism; and the developmental aspects of iron deficiency.

Studies in animals are considering the low insulin metabolic response of the spiny mouse; spontaneous diabetes in the Wistar rat; dietary interactions of molybdenum and copper; and the metabolic functions of carotenoids and vitamin A.

One of the main avenues through which NIH supports international nutrition research activities is the U.S.-Japan Cooperative Medical Science Program and its Malnutrition Panel. Specific areas of research involve studies on the effects of nutrition on physical and mental development, work performance, and behavior; the health consequences of changing dietary patterns and food habits; the interaction of nutrition, immune competence and infection; and the influence of environmental and host factors on nutritional requirements. These areas are being investigated in order to primarily assist the undernourished people of Asia.

In some areas of India, 5 to 10 percent of all children exhibit clinical signs of vitamin A deficiency. A study is investigating the impact of nutritional deficiencies on the eye and possible means of prevention and treatment. Another study is planned to look at risk factors, other than vitamin A deficiency, which make the malnourished child particularly susceptible to becoming blind.

International nutrition research to look at environmental contaminants includes investigations on adaptive metabolic responses in gastrointestinal and pulmonary tissues to environmental zenobiotics. The influences of polybrominated biphenyl, polychlorinated biphenyl, and polychlorinated naphthalenes on biotransformation rates are being studied, as are the relationship between induction and the tissue level of zenobiotics. Intestinal biotransformation regulation by dietary factors is being evaluated in *in vitro* models and isolated intestinal sacs.

Nutrition Education for Professionals

In FY 1981, NCI, NHLBI, NIADDK, NICHD, and NIA supported nutrition education activities for professionals for a total of $11,639,000 or 8 percent of the total nutrition research expenditures. The NCI and NHLBI have specific mandates for providing education programs to professionals.

The NIH provides nutrition education to professionals through a variety of means. The latest developments in NIH funded nutrition research are published in such medical and scientific journals as the *Journal of the American Medical Association*, *American Journal of Clinical Nutrition*, *Journal of Pediatrics*, *Journal of the National Cancer Institute*, *Journal of Clinical Investigation*, *New England Journal of Medicine*, *Journal of the American Dietetic Association*, and many others. For example, the June 1981 supplement to the *American Journal of Clinical Nutrition*, Volume 34, contained the "Proceedings of the NIH Workshop on the Nutritional Support of the Patient: Research Directions for the 1980s."

Other nutrition publications published primarily for professionals by various NIH Institutes as well as the NCC office include: three publications, "Obesity: Does it Modulate Infectious Disease and Immunity," "Overview of Nutritional Status in the United States," and "National Nutrition Policy in the United States" that appeared in *Nutrition in the 1980s, Constraints on Our Knowledge* (Alan R. Liss, Inc., New York); two publications, "A Model Workshop for Nutrition Counseling for the Reduction of Cardiovascular Risk Factors," and "A Manual in Nutrition Counseling for the Prevention of Coronary Heart Disease," prepared jointly by NHLBI and the American Heart Association, are intended to enhance the interviewing and counseling skills of the nutrition counselor. In addition, the tenth revision of the *Recommended Dietary Allowances* (RDA's) and a manual entitled *How To Use The RDA's* are being prepared through a contract with the Food and Nutrition Board, National Research Council (NRC) of the National Academy of Sciences (NAS).

An extensive effort in professional education includes continuing education courses that are provided for paramedical personnel, medical students, nurses, residents, practicing physicians, and research scientists. Much of this effort is provided through the Clinical Nutrition Research Units. All seven CNRU's supported by NIH have active professional education programs in accordance with one of the three stated objectives of a CNRU: "To strengthen training environments in order to improve the education of medical students, house staff, practicing physicians, and paramedical personnel in clinical nutrition."

Individual postdoctoral fellowships, research career development awards and prevention oncology awards are available to the professional as well as continuing education courses that range from basic principles of cancer biology to current methods of cancer detection, diagnosis, treatment, and rehabilitation. The regional cancer centers serve as a resource, planning and evaluative focus to assist other facilities in providing teaching programs, to develop "lecture banks" and comprehensive and specialized clinical electives.

NIH sponsored workshops and conferences are another important mechanism for imparting nutrition education to professionals. In FY 1981, NCI, NHLBI, NIADDK, NIGMS, NICHD, NEI, NIA, FIC, and the Nutrition Coordinating Committee sponsored 23 such activities that are listed on pages 30-31 of this report.

One study, described in detail in the section on Nutrition Education Research, evaluated the effectiveness of three different methods of nutrition education for health sciences professionals. The study results indicate that some personal contact with the student population appears highly desirable for successful academic teaching in nutrition.

Nutrition Education for the Public

Although the primary mission of the NIH is in biomedical and behavioral nutrition research and training, nutrition education for the public is an integral part of many programs. Efforts are continually being made to translate the results of nutrition research into practical information for the American public. In FY 1981, $2,769,000, or 2 percent of the total nutrition budget, was devoted to projects with significant effort in nutrition education for the public. In addition to NCI and NHLBI, both of which have specific mandates for information and education, work in this area is also carried out by NIDR, NIADDK, NICHD, DRR, and the NIH Nutrition Coordinating Committee office.

Information is disseminated through a variety of mechanisms. Publications dealing specifically with nutrition are available through the various Institutes' information offices. The nutrition publications available to the public in FY 1981 include: Questions About Weight, Salt and High Blood Pressure, Fact Sheet Hyperlipoproteinemia, and Model

Workshop for Nutrition Counseling in Hyperlipidemia, (NHLBI); "NIA Age Page, Food: Staying Healthy After 65," (NIA); Food Allergy, (NIAID); and Snack Facts, (NIDR). The USDA/DHHS publication, Nutrition and Your Health, Dietary Guidelines for Americans, is also available to the public from the Consumer Information Center, Pueblo, Colorado.

Public racks in almost 3,000 supermarkets, drug stores and department stores are stocked with NIH publications.

One public service program, entitled "Living with Aging" and done in collaboration with the NIH and Peoples Drug Store, is providing the elderly and their families with important health promotion information. "Food for Life After Age 65" and "Taking Care of Your Teeth" are two of the eight free brochures that are being displayed in all of the Peoples' 525 drug stores in 14 states and the District of Columbia. These brochures, designed and printed by the drug store, are based entirely on the existing Age Page publication by NIA.

The Age Page also serves as a source of information to many health columns that appear in newspapers and newsletters thoughout the country. The Information Office of NIA has received approximately 8,700 requests for further information on nutrition since the appearance of some hundred articles based on the Age Page, "Food: Staying Healthy After 65." This issue also served as the basis for a television program entitled "Health Field," which is aired in the New York area.

The NIH has also developed a number of public service announcements (PSA's) on nutrition; "Magical Munching" is a television PSA released by NIDR in FY 1981 that describes, in 30-second spots, those foods which are desirable snacks. In addition, a collection of articles about NIH research developments is contained in the publication, NIH News and Features; approximately 8 to 10 percent of its content contains nutrition research activities and highlights.

Another means of providing nutrition education to the public is through the NIH lecture series, "Medicine for the Layman," which is now in its fourth year. In FY 1981, the series included a lecture on "Cholesterol and Heart Disease." The series is videotaped for possible use on public television.

A number of studies are under way to evaluate the various means of educating certain segments of the general public about different aspects of nutrition. These projects are described in more detail under the special interest area on Nutrition Education Research presented on pages 87-89 of this report. One result of these research activities has been the development of the Nutrition Education Instruction System (NEIS). This system has been shown to increase preschoolers' knowledge of nutrition facts and to cause a desirable alteration of food choices.

Nutrition education and information programs are also integrated into various cancer and heart disease education programs. Efforts are under way to educate the public on the role of diet and nutrition in cancer etiology and prevention, as well as in the treatment and rehabilitiation of the cancer patient. The Diet, Nutrition and Cancer Program, NCI, has developed and distributed a number of pamphlets and handbooks to advise cancer patients on the role of nutrition and cancer therapy. Work with the Candlelighters also continues in order to develop resource material for the child with cancer. Community based programs that educate the public on cancer also include nutrition information as a major component.

Those programs designed to translate the results of fundamental research in heart disease into practical suggestions for all Americans include the most recent scientific information on the role of nutrition. Good heart health through "prudent self reliance" is especially important in nutrition where eating choices are both controversial and elective. One successful education program entitled "Foods for Health," initiated by NHLBI in cooperation with Giant Foods, Inc. in FY 1978, provided supermarket consumers with free information on the relationship of diet and coronary heart disease through publications known as "Eaters Almanacs." Numerous requests to reprint the almanacs continue to be received in FY 1981.

Other mass media campaigns are part of the National High Blood Pressure Education Program. Messages emphasizing the potential role of sodium restriction and weight control in high blood pressure control are presented through radio and television spots.

In both cancer and heart disease, targeted populations are being exposed to nutrition education materials for the maintenance of health or treatment of disease. These NIH nutrition education programs appear to be successful and indicate that people given sound applicable information are in fact willing to change and improve their dietary habits.

In addition, the NCC served as consultants in the production of a videotape series entitled "Eat Well, Be Well" that was produced by Amram Nowak Associates under contract with Metropolitan Life Insurance Company. Pages 103-104 of this report describe the series in detail, the responses to the series, as well as the initiation of its sequel, "Eat Well, Be Well II."

The NCC Subcommittee on Nutrition Education took an active role in developing nutrition education pamphlets and fact sheets for the general public. A major subcommittee project, entitled "Expanded Foods For Health," includes scientific information on a variety of nutrition topics available as eight fact sheets with a unifying logo. The subcommittee also developed a comprehensive program of nutrition activities that were carried out at the NIH during National Nutrition Month, March 1981. The nutrition education activities of the subcommittee are described in detail on pages 107-109 of this report.

Another service provided by all the Institutes and by the NCC is the handling of public inquiries, both by mail and telephone. Information specialists are available during working hours to answer any questions--lay or professional--not only on nutrition, but also on all research topics within the purview of the NIH. In addition, the NCC maintains a full-time office staff to provide support to the committee and to serve as a focal point for nutrition information. The NCC office responds to inquiries from the scientific community, the media, and the concerned public.

Nutrition Education Research

Nutrition education research is a component of several NHLBI intervention programs and clinical trials, the Clinical Nutrition Research Units supported by NCI and NIADDK, and research sponsored by NICHD. In FY 1981, $2,667,000, or 2 percent of the total NIH nutrition expenditures, supported activities with significant nutrition education research components.

Nutrition education research is an important component of a number of intervention studies dealing primarily with hypertension control. Two such cooperative clinical trials under way are assessing the effectiveness of diet therapy (weight control or sodium restriction) as an adjunct to or substitute for drug therapy for hypertension. Five pilot community studies of persons living in two urban and three rural communities, known to have a high prevalence of hypertension, are evaluating various methods of controlling hypertension, including education on the role of diet. Results from this research will help communities devise practical and effective programs for hypertension detection, education, followup and control.

Research on ways to control hypertension also take place at the work site. The intervention techniques studied include a general education program about high blood pressure, its consequences and treatment; a detection program to identify persons at high risk of high blood pressure and a specific education program that includes dietary counseling for those persons identified as being at risk. Results indicate that short-term hypertension control in the work setting is feasible through intervention techniques for the selected work sites. Currently, data analyses are focusing on identifying the most effective.

The intervention trial, MRFIT, was designed in part to measure dietary adherence while simultaneously evaluating the effects of intervention on several risk factors (elevated serum cholesterol, elevated diastolic blood pressure, and cigarette smoking) associated with death from coronary disease. In order to lower serum cholesterol levels the dietary intervention program utilizes techniques and knowledge of group dynamics and behavior modification. A number of publications with information on the methodology and early results of the MRFIT nutrition intervention and evaluation programs have been published in the *Journal of the American Dietetic Association* (Vol. 76, 1980; Vol. 77, 1980; Vol. 78, 1981) and in *Preventive Medicine* (Vol. 10, 1981). The intervention monograph was also published in Preventive Medicine; 10:387, July 1981. A "Quality Control Monograph," a "Manual of Nutrition Education Techniques and Materials," and a "Baseline Data Monograph" are also in preparation.

Another program to evaluate cardiovascular disease prevention strategies is the Chicago Heart Health Curriculum Program, which is being carried out in sixth grade students of Chicago city schools. This program will evaluate the relationship among knowledge, attitudes, and behaviors that are consistent with the development of the type of lifestyle that may enhance the prevention of cardiovascular disease. Teachers and parents participate in the training workshops and education programs that encourage environments conducive to a heart healthy lifestyle for the student.

Teaching strategies were compared in data analyzed from another nutrition education program designed to teach hyperlipidemic men and women ways to change their food habits in order to lower serum cholesterol levels. In this research a method called a "Diet Achievement Score" was designed to determine adherence to a cholesterol lowering dietary regime. Significant changes noted in the study group contrasted to a comparison group include: improvement in nutrition information scores; decreases in calorie and cholesterol intakes and in the percent of calories from fat, especially saturated fat; and increases in the percent of calories from polyunsaturated fat. Of the four teaching methods tested--individual, group, self and multi--no one method appeared to be significantly superior, however, the multimethod was slightly better.

The CNRU's are also a significant foci for nutrition education research since their mission is to combine research, patient care, and public education activities, often in the form of community outreach programs. Examples of the research under way at the CNRU's include projects to evaluate the effectiveness of various in-service programs that contain basic nutrition information, and to develop innovative teaching tools for children with juvenile diabetes that can be adapted to each child's age and preferred learning mode. Research to develop nutrition education programs useful to fostering proper nutritional habits in children and adults, both professsional and nonprofessionals, is an important undertaking of the CNRU's.

A number of projects to determine appropriate nutrition education methods for children and their parents are included in this special interest area. One program, entitled the Nutrition Education Instruction System, aims to develop and evaluate a method of teaching self-management techniques to preschool children and kindergarteners and to evaluate whether a program that teaches children how to apply self-management skills for developing health oriented behaviors (related to nutrition, dental hygiene, harmful substances, and health advocacy) has an impact on lifestyle.

Another project on the development of positive health behavior in preschoolers investigates the antecedents of positive and negative health behaviors early in childhood with the aim of producing an effective health education program that will have a lasting effect on adult health behaviors.

A study entitled "Infant Feeding Problems Today: Implications for Nutrition Education" interviewed mothers of 1-year-old infants to determine the mothers' exposure to nutrition information and its relationship to their feeding choices. Results of the study indicate that breast-feeding mothers are more inclined to follow the advice of friends, classes, and literature. Pediatrician's advice was followed most carefully by mothers who fed formula to their babies, who introduced solids before age 6 months, or who had low birth weight infants.

Another project involves developing teaching materials for independent instruction in basic nutrition facts and testing the efficacy of programmed nutrition educational packages. Data collected thus far indicate that this method is effective in teaching facts but not in guiding students in the practical application of these facts. A project entitled "Nutrition Education Via Telecommunications Satellite" is designed to compare the effectiveness of the following three methods of nutrition education for health professionals: videotapes plus regular classroom discussion session; videotapes and structured discussion via satellite; and videotapes and informal off-campus discussion sessions.

The causes, prevention, and treatment of obesity in children is an important research issue. As a result, nutrition education research projects attempt to develop appropriate behavior modification methods that may prove useful. One project is designed to ascertain whether the teaching of eating or exercise behavior should receive the most emphasis in a home-based behavior program. A related project is developing and evaluating a behavior modification program for families of obese children that consists of a program to train parents in general child management skills, and encourages behavior modification by the parents, even though the obese child is the target of the intervention. Other studies are evaluating management strategies for overweight children, as well as those for children with Prader-Willi syndrome.

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II.
NUTRITION COORDINATING COMMITTEE

Nutrition is an important, crosscutting program area within the NIH. For this reason, the nutrition program is coordinated through the Nutrition Coordinating Committee that operates out of the Office of the Director and is advisory to the Director. The committee is the focus for the review of nutrition research priorities and training, their coordination, and for the development of the NIH program in biomedical and behavioral nutrition research and training. This focus minimizes duplication of effort among the Institutes and identifies areas where research, research training and manpower development in nutrition need to be advanced.

COMMITTEE STRUCTURE

The Nutrition Coordinating Committee operates out of the Office of the Director and is advisory to the Director, NIH. The membership of the NCC consists of representatives from the 11 Institutes and the Division that support nutrition research. Additional NIH offices, other agencies of the Public Health Service and the Department of Health and Human Services, and the Office of Science and Technology Policy in the Executive Office of the President have liaison representatives to the Committee. As of September 30, 1981, the NCC was composed of 2 officers, 24 members and alternates, 10 liaison representatives and alternates from interested offices within the NIH, and 9 liaison representatives and alternates from other Federal agencies.

The committee, established in 1975, reviews and comments on the plans, execution, and results of pertinent Bureau, Institute, and Division research efforts relating to nutrition in order to develop the Annual Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training. In addition to staffing the NCC, the office staff provides information requested by the Office of the Director, and represents NIH in numerous activities involving nutrition research at DHHS, the Office of Science and Technology Policy, other Federal and non-Federal agencies, industry, and professional societies. The NCC office also maintains information on national and international nutrition meetings and conferences.

NCC meetings are normally held once a month and are attended by the members, liaison representatives, and committee office staff. In addition to the regular business of the committee, special presentations on subjects of current interest to the NCC are frequently made by scientists from other agencies or groups. FY 1980 marked the beginning of the special Scientific Seminars in Nutrition presented during the last hour of each NCC meeting. These special seminars continued in FY 1981 with presentations made by extramural, intramural, and visiting scientists engaged in nutrition research at the NIH as well as scientists involved in nutrition research at other government agencies.

In addition to committee activities, a number of special activities were carried out through the NCC Subcommittee on Nutrition Education. The Subcommittee on Nutrition Education was restructured in March 1981 to include representatives from NCI, NEI, NHLBI, NIDR, the Clinical Center, the Office of Communications and the NCC Office. Dr. David Wolff, NIDR, and Ms. Karen Donato, NCC office, cochair the Subcommittee and Ms. Donato serves as the Executive Secretary. The first meeting of this newly structured subcommittee was held on June 22, 1981.

The charge of the Subcommittee on Nutrition Education is:

- To review NIH nutrition publications designed for the public
- To develop public service announcements
- Complete the "Expanded Foods for Health" project

- Develop and implement National Nutrition Month activities at NIH

COMMITTEE ACTIVITIES AND ACCOMPLISHMENTS

Scientific Seminars

In order to highlight research in nutrition, especially that research carried out by intramural scientists at the NIH, and to keep the NCC representatives informed of research developments in nutrition, the NCC inaugurated a program series called Scientific Seminars in Nutrition. The seminars are presented during the second hour of the monthly NCC meeting. During FY 1981, the following seven Scientific Seminars in Nutrition were presented:

1) "ADAMHA's Nutrition Research Program" was presented by Dr. Ellen Stover, Chief, Small Grants Program, ADAMHA, on October 16, 1980. A summary of her presentation follows:

The Alcohol, Drug Abuse and Mental Health Administration that consists of the National Institute of Alcohol Abuse and Alcoholism, the National Institute of Mental Health and the National Institute of Drug Abuse (NIDA) is interested in various aspects of nutrition research. The NIAAA provides support for research in areas of nutrition which are of importance to the subject of alcoholism and alcohol abuse. Examples of alcoholism relevant nutrition research include the following areas:

- The effect of alcohol as a nutrient, as distinct from a pharmacologic agent, on central nervous system functions. This may encompass any or all of the disciplines of the neurosciences.
- Alcohol as a nutrient, as distinct from a pharmacologic agent, and its actions on metabolism and physiology.
- The effects of alcohol on vitamin and mineral metabolism.
- Primary and secondary malnutrition from alcohol--the mechanisms of action which underlie the pathology of alcoholism.

The NIMH supports biological, behavioral, and psychosocial research related to mental health and mental illness. The following areas of emphasis are examples of areas of interest in nutrition:

- Clinical and applied studies of the relationship of eating behavior and nutritional status on mental disorders.
- Research to assess the interactions between psychotherapeutic drugs and treatments and the nutritional status of psychiatric patients.

- Basic studies designed to understand the biological, behavioral, motivational, and social processes which underlie eating behavior and nutritional status including studies to understand the psychological and biological mechanisms involved in the prevention, development, and treatment of obesity and anorexia nervosa.

- Development of measures to assess differences in individuals which may predict susceptibility to weight related problems (such as personality factors, family factors, genetic disposition).

- Studies involving the use of nutrients or other dietary substances as part of a therapeutic regimen for behavioral disorders.

- Clinical studies to determine whether psychiatric disorders may influence eating behaviors--to explore possible nutritional components of mental disorders.

- Studies of nutritional deficiencies or excess in some individuals with mental disorders (such as low zinc in schizophrenics).

- Research on possible food allergies which may produce symptoms or behaviors characteristic of mental disorders.

ADAMHA also supports nutrition research as part of its intramural program. One intramural study is investigating the psychosocial and biomedical interactions influencing glucose metabolism in insulin-dependent diabetes and anorexia nervosa. Other work includes research on the effects of early malnutrition on children's social and emotional functioning, studies on the complex relationship between clinical disorders, biochemistry, diet, and sleep; studies on the chemical and environmental stimuli that release beta-endorphin from the pituitary and the relationship of the beta-endorphine levels to obesity; studies on the effects of acetylcholine or lecithin treatment on memory function in Alzheimer's disease; and clinical trials of lithium and tetrahydracannabinol in the treatment of anorexia nervosa.

Dr. Stover concluded her presentation with an explanation of the ADAMHA Small Grant Program. This program provides relatively rapid financial support that is principally intended for newer or less experienced investigators, those at small colleges, and others who have neither regular research grant support nor resources available from their institutions. Small grants may be used to carry out exploratory or pilot studies, to develop and test a new technique or method, or to analyze data previously collected. The Small Grant Program invites applications for research grants that cover the entire range of scientific areas relevant to mental health, or to drug or alcohol abuse. Proposals may involve a wide variety of biomedical, behavioral, and related disciplines relevant to the missions of ADAMHA.

2) "Determining the Cariogenic Potential of Foods" was presented by Dr. William H. Bowen, Chief, Caries Prevention and Research Branch, National Caries Program, NIDR, at the November 20, 1980, NCC meeting. A summary of his presentation follows:

During the past several years an increasing level of research has been directed toward determining the cariogenic potential of specific foods. The term "cariogenic potential" is used deliberately because the ability of any particular foodstuff to contribute to the initiation of caries is determined by many factors, of which sugar content and the frequency of ingestion are of prime importance.

Many methods have been used to try to determine the cariogenic potential of foods. The one method most widely accepted is that of Grof and Muhlemann in which an indwelling electrode technique is used to measure the effect of the foodstuff on the pH of plaque. A food that does not lower the pH of plaque below 5.7 is regarded as "kind to teeth" and is given official recognition as such by the Swiss government. However, it is uncertain whether a food that lowers the pH of plaque to a value of 5.0 and is consumed once daily should be regarded as more cariogenic than one that induces a pH of 5.7 but is consumed several times daily.

For years it has been recognized that rats develop dental caries when fed highly sugared diets. It has also been recognized that they may change their frequency of eating when offered a variety of foods. In order to overcome this difficulty, investigations to determine the cariogenic potential of foods were carried out by feeding rats essential nutrition by gastric intubation and the test substances through a programmed feeder that controls the time and frequency of exposure to a food. The incidence of caries induced by various foods can thus be directly compared, and any failures to ingest the diet noted. Because the test food is the only material that directly contacts the teeth, carious lesions that develop can be directly related to the ingestion of test food. Furthermore, by using this technique the influence of specific foods on plaque flora may be studied.

Results from a number of experiments utilizing this method show that in the absence of food taken orally, caries do not develop in rats and, furthermore, that the level of caries is directly related to the frequency of sucrose ingestion. The results also show that it is possible to distinguish the caries-promoting ability between foodstuffs and that some products are more cariogenic than sucrose. The absolute number of lesions induced by 17 daily meals of sucrose varied with the experiment, but the ratio of the number of lesions induced by eight such meals to those induced by 17 meals was almost identical.

The scores for caries associated with the ingestion of test foods can be expressed as ratios of those associated with 17 meals of sucrose in order to compare the cariogenic potential of foodstuffs from one experiment to another. This ratio is termed the cariogenic potential index (CPI). Results also show that sucrose and the frequency of sucrose ingestion has a significant effect on the establishment and growth of streptococcus mutans in the mouths of animals.

Of the foods for which the CPI has been determined, cookies, especially chocolate cookies with a soft filling, appeared to be more cariogenic than sucrose and also promoted the implantation of streptococcus mutans in the animals. Breakfast cereals that contain 8, 14 or 60 percent sucrose are almost equally cariogenic, while sugar coated chocolate candy and potato chips are more cariogenic than caramels and chocolate bars. The study results show that the relative cariogencity of a food cannot be assessed simply on the basis of sugar concentration. Constituents of foods can influence their cariogenicity by reducing or enhancing the effect of sugars.

Dr. Bowen concluded that it is difficult to extrapolate the results achieved in animal studies directly to humans, and that a universally accepted test to determine the cariogenic potential of foodstuffs applicable to humans has not yet been devised. He said that the approach used in these experiments can establish differences in the cariogenic potential of foods in a simple, unequivocal, and reproducible manner.

3) "Potential Neurotoxicity of Artificial Food Colors" was presented by Ellen K. Silbergeld, Ph.D., Chief, Neurotoxicity Section, NINCDS, at the December 18, 1980, NCC meeting. A summary of her presentation follows:

The potential effects of artificial additives in food on children's learning and behavior has been of considerable public concern over the past 5 years. The food additive hypothesis, first formulated by Dr. Ben Feingold, has focused primarily on the role of artificial food and drug coloring agents as etiologic factors in producing some symptoms of minimal brain dysfunction or attention deficit disorder, a poorly understood cluster of neuropsychiatric problems diagnosed in 5-15 percent of American children between 3 and 12 years of age.

The two types of clinical studies done to identify the involvement of artificial food dyes in hyperactivity include fairly long intervention studies that attempt to eliminate foods known to contain artificial colors and flavors, followed by subsequent documentation of the intensity and frequency of hyperactive behavior; and "challenge studies" that administer acute doses of additives to children known to respond favorably to the elimination diets in order to observe any dramatic changes in behavior. The clinical studies have not shown any dramatic evidence to support the neuroactive nature of artificial additives under the conditions of their protocols. These studies are particularly difficult to perform and, in some instances to interpret, since dietary intervention brings a large measure of psychological manipulation that may have profound and possibly beneficial effects on parent-child interactions.

Research on animals has been carried out to study the possible neuroactive effects of one of the most commonly used artificial colors, erythosin B (F.D. & C. Red No. 3). In vitro studies have shown that erythosin can inhibit uptake of neurotransmitters by nerve endings. The dye appears to interfere with neurotransmission by inhibiting the activity of the enzyme Na-K-ATPase located in brain tissue which is responsible for transporting and regulating sodium and potassium throughout the body. The dye exerts significant inhibition at concentrations as low as 10^{-9}M. An interesting aspect of the identification of the site of action of erythosin is that the Na-K-ATPase enzyme is under genetic control. Thus, there may be a subgroup of children with minimal brain dysfunction or attention deficit disorder that are sensitive to the dye and possibly other food additives. Dr. Silbergeld concluded that scientists are currently studying how red dye #3 binds to nerve cells by tagging the dye with a radiolabel, so it can be tracked on its journey through the nervous system. Such in vitro studies are important to establish the toxic effects of these dyes before any definitive association can be made between them and hyperactivity.

4) "Dietary Factors Affecting High Density Lipoprotein (HDL) Levels" was presented by Dr. Ernst Schaefer, M.D., Senior Investigator, Molecular Diseases Branch, NHLBI at the February 26, 1981, NCC meeting. A summary of his presentation follows:

Today, a great deal of evidence exists that diets high in fat, especially saturated fat, and cholesterol cause significant elevations in plasma cholesterol in man, while diets low in these constituents cause a decrease in cholesterol levels. Cholesterol, phospholipid, and triglyceride in conjunction with various protein contituents known as apoproteins, are carried in the blood in the form of spherical lipoprotein particles of varying size and density. The density of these lipoproteins is determined by their relative lipid and protein content. Within each lipoprotein density class there may exist a variety of lipoprotein particles that can vary in their apolipoprotein content and site of synthesis. Elevated low density lipoprotein (LDL) cholesterol and decreased high density lipoprotein cholesterol plasma levels have been independently associated with an increased risk for premature coronary heart disease (CHD) in man. The purpose of the research described below was to examine the effects of 1) a low cholesterol diet, 2) a high polyunsaturated fat, low cholesterol diet, and 3) a low fat, low cholesterol diet on plasma lipid and lipoprotein cholesterol concentrations in normal and hypercholesterolemic subjects.

Subjects were admitted to the study while on a baseline ad libitum diet of normal composition. Subsequently, they were placed on either of the three following diets: Diet A was a 20 percent protein, 40 percent carbohydrate, and 40 percent fat, with a polyunsaturated: saturated fat (P/S) ratio of 0.1-0.3, 250-300 mg cholesterol diet; diet B was identical to diet A except that the P/S ratio was 1.8-2.2; and diet C was a 20 percent protein, 80 percent carbohydrate, very low fat (5-10 grams), P/S ratio 0.1-0.3, 150-200 mg cholesterol diet. The increased carbohydrate in diet C was given mainly in the form of simple carbohydrate with noodles, matzoh, fruit, jello and ginger ale. All subjects were on the study diets for a minimum of 14 days.

Diet A differed from the baseline diet mainly in its reduced cholesterol content and caused a mean reduction in plasma cholesterol, LDL cholesterol and HDL cholesterol of 5.9, 5.6, and 6.3 percent respectively in the 11 normal subjects. Diet B (low cholesterol, high saturated fat) caused significant decreases in plasma cholesterol, LDL cholesterol and HDL cholesterol of 17.0, 16.2, and 17.4 percent respectively in 12 normal subjects and reductions of 11.0, 10.8, and 17.1 percent respectively in 19 hypercholesterolemic subjects. Diet C had a significantly lower fat and cholesterol content and a much higher carbohydrate content than the baseline diet. This diet produced statistically significant mean decreases in plasma, LDL, and HDL cholesterol of 26.2, 29.9, and 27.9 percent respectively in 11 normal subjects, and of 22.6, 27.2, and 28.6 percent respectively in 9 hypercholesterolemic patients.

None of the diets, A, B, or C, produced any significant changes in the ratio of LDL cholesterol:HDL cholesterol in either the normal or hypercholesterolemic group. The data suggest that a low cholesterol diet may cause modest decreases in both LDL and HDL cholesterol, that diets with a high P/S ratio cause reductions in both LDL and HDL cholesterol in both normal and hypercholesterolemic subjects, and that a very low fat, high carbohydrate diet causes decreases in plasma, LDL, and HDL cholesterol concentrations in both normal and hypercholesterolemic subjects.

Dr. Schaefer concluded that the data suggest that combining the features of all three diets, i.e., cholesterol restriction, increased P/S ratio, and fat restriction could result in an even greater decrease in plasma, LDL, and HDL cholesterol levels. Populations that consume diets low in fat and cholesterol with an increased P/S ratio have age-adjusted coronary heart disease mortality rates that are significantly lower than populations consuming diets similar to the average American diet. It would appear that at least acutely, such diets lower total LDL and HDL cholesterol levels to a comparable degree.

5) "Health Related Household Food Pattern Changes" was presented by Ms. Judith Jones Putnam, Social Science Analyst in the National Economics and Statistics Service, USDA, at the March 26, 1981, NCC meeting. A summary of her presentation follows:

The Economics and Statistics Service (ESS) of USDA conducted a survey of 1,353 households in January, 1980, on self-reported dietary changes for reasons of health or nutrition in the 3 years prior to the survey. Questions were asked about the household's current frequency-of-use patterns for 37 food and beverage categories, as well as whether the household made any recent changes in the use of specific foods for reasons of health or nutrition. Sixty-four percent of the households reported making at least one dietary change for reasons of health or nutrition. The following dietary changes were noted. Of all the households:

- 15-20 percent reported using less bacon, sausage, hot dogs or luncheon meats, eggs, beef, and fresh pork,
- 11 percent changed the type of milk consumed, with 90 percent substituting low fat milk for milk with a higher fat content,
- 1 in 10 changed the type of margarine or other fats and oils with the direction of the change toward the use of soft margarines and vegetable oils,
- 1 in 4 reported an increase in fruit and vegetable consumption,
- 1 in 7 substituted whole grain bread for white bread,

- 1 in 10 reported reduced consumption of bread,
- 7 percent shifted from high sugar cereals to those with less sugar,
- 22 percent reduced their use of salty foods and snacks, and
- 3 in 10 reduced their use of sugar and sugary foods such as candy, sweet desserts, and sweet baked goods (reduced use of regular soft drinks, beverage powders, and high sugar cereals).

A variety of specific health/nutrition concerns were cited as reasons for the dietary changes. The "concerned households" averaged higher incomes than the rest of the sample, were less likely to be one-person units, and tended to have more formal education. These concerns are as follows:

- "concern about excess sugar" - 52 percent of the households making diet changes for reasons of health mentioned reducing sugar intake.
- "concern about calorie intake/weight control" - 43 percent of households cited weight control as the primary reason for at least one change. In 61 percent of households, one member tried to lose weight in the year prior to the survey; 29 percent of the people in all sample households attempted to lose weight during the year.
- "concern about salt intake/blood pressure control" - 29 percent of households mentioned concern about reducing salt intake or controlling blood pressure.
- "concern about fat intake" - 28 percent of households wanted to reduce fat intake.
- "concern about cholesterol intake" - 23 percent of households wanted to reduce their cholesterol intake.
- "concern about food additives" - among the households that made at least one dietary change for reasons of health or nutrition, 12 percent specifically mentioned the reduction of nitrite intake and 5 percent mentioned the reduction of saccharin intake. Ten percent said they made a change in food use in order to reduce intakes of preservatives, colorings, and other (nonspecified) additives.

In terms of the influential sources of nutrition information, 56 percent of the respondents from households making diet changes for health or nutrition cited doctors, dentists, or nurses as their sources of influence. The elderly and those with the least schooling were more likely to cite these health professionals as their influential sources of information. Magazines, newspapers, and television were each cited as influential sources of information by about one-third of the respondents in households changing their food practices; health and diet books were mentioned by one-fourth. One-fifth of the respondents said that food labels were important sources of information influencing diet modification.

Many of the consumers surveyed had important misconceptions about food and nutrition. Most of the U.S. consumers want the government to ensure adequate information in the market place through stepped-up nutrition research. They want more effective information and education efforts to communicate up-to-date factual knowledge about the relationship between health and diet, and improved food labeling so they can moderate their diets through individual decisions.

Ms. Putnam concluded that the survey indicated that people are concerned about their diet and its relationship to health, and need better information and guidance to clear up any misconceptions. Since consumers rely on health professionals, the media, and food labeling for dietary information and guidance, adequate training of health professionals on nutrition, more nutrition labeling on food products, and high quality objective information on nutrition from the media are all obvious recommendations. In addition, new educational techniques and broader participation in nutrition education by food marketers is needed.

6) "Effects of Unsaturated Fatty Acids on the Development and Proliferation of Normal and Neoplastic Breast Epithelium" was presented by Dr. William R. Kidwell, Chief of Cell Cycle Regulation Section, Laboratory of Pathophysiology, NCI, at the June 25, 1981, NCC meeting. A summary of his presentation follows:

Epidemiological analyses have shown that a positive correlation exists between the amount of animal fat consumed and the incidence of mammary cancer. Studies with experimental animals have pointed to lipids as causal agents and have suggested that the selective effect of unsaturated fatty acids in the development of breast cancer is due to a direct action of these fatty acids on the breast epithelium, rather than being indirectly manifest. It is clear that a special relationship exists between the glandular epithelium and the adipocyte matrix in which it is embedded. For example, the epithelium selectively transplants into the mammary fat pad or, in explants, grows only to the confines of the accompanying mammary adipose tissue.

In order to more clearly understand the role of fatty acids in the development of mammary cancer, we have examined some of the responses of the epithelium to lipids, both in vivo and in vitro. The results of these studies indicate that the proliferation and development of the glandular epithelium are dramatically affected by the types of fatty acids to which it is exposed. In response to a proliferative stimulus, the lipid composition of the mammary gland changes with an increase in the relative amount of unsaturated vs. saturated fatty acids. This increase favors the proliferative response to the growth stimulus because the epithelium is stimulated by unsaturated fatty acids and inhibited by saturated fatty acids. Membranes isolated from proliferating epithelium are twofold richer in unsaturated fatty acids in their phospholipids than membranes from resting epithelium.

The hormone prolactin is an agent that effects this change in the degree of unsaturation of membrane phospholipids. This hormone interacts with the epithelium that contains all of the prolactin receptors of the gland, and, as a consequence of signals from the epithelium, causes neighboring adipocytes to release free fatty acids. A selective uptake of unsaturated fatty acids by the proliferating epithelium then follows. An interesting aspect of this change in the degree of unsaturation of the membrane phospholipids is that it may afford a means of amplifying the response of the cells to prolactin. Prolactin induces its own receptors in vivo but can only do so if the animal has sufficient stores of essential fatty acids. Essential and nonessential fatty acids do not initiate cell division, but rather facilitate the rate at which cell division can take place.

Dr. Kidwell concluded that essential fatty acids also play an important role in the development of the mammary epithelium. When animals are deprived of essential fatty acids in utero, the mammary tree, both ducts and alveoli, fail to develop. The response of the glandular epithelium to unsaturated fatty acids (and essential fatty acids in particular) may therefore lead to increased incidence of mammary cancer by two mechanisms: an increased rate of proliferation of transformed cells, and an increased risk of transformation by expansion of the epithelial cell population at risk for transformation.

7) "Storage & Retrieval Using the Video Disc" was presented by Dr. James Woods, Director of the National Medical Audiovisual Center, National Library of Medicine, at the September 24, 1981, NCC meeting. A summary of his presentation follows:

The video disc has evolved over the past 30 years with advances in instructional devices that started from 3 x 4 lattern slides in monochrome, to the kodachrome slide, to color movies, to videotape (first monochrome and then in color), and to computers. The features of the optical video disc are:

- The disc is capable of storing 54,000 individual video frames (pictures) on each side of the disc.
- Using the standard industrial player, one can access any one of the frames in less than 2 seconds.
- Any frame can be viewed for an indefinite length of time without any deleterious effect on the disc.
- Any series of frames can be viewed at a rate stated by the user starting anywhere and ending anywhere.
- Individual frames and sequences of frames are randomly accessible almost instantaneously; they can be viewed in reverse order in real time or at a variable rate in slow motion.
- Motion can be in real time, variable rate slow motion, or single

frame. In real time forward motion, two audio tracks are simultaneously available that can be used for bilingual presentations.

The optical disc is a permanent device without a half-life, since: 1) the active surface in the disc is sealed and is merely a series of pits burned into the surface; and 2) the playback device reads the disc with a laser beam. The playback activity can be controlled by either programming the internal microprocessor or by interfacing the disc with any digital computer.

The mission of the National Medical Audiovisual Center (NMAC) is to promote and support use of the audiovisual technology in health education. Two current projects are now underway by the NMAC that involve the video disc. One project is studying the quality of reproduction, cost per frame, sequencing and indexing of some of the 80,000 photographs in the NLM collection that are currently only available to scholars in Bethesda. The second project involves using the video disc to educate students on health issues or items previously seen only through a microscope, or taught by an instructor.

Dr. Woods concluded that the ability to program the video disc is limited only by available random access memory and by the ingenuity of the programmer. Programming can be done on the disc itself by programming the microprocessor, and by interfacing with external computers.

The Videotape Series, "EAT WELL, BE WELL"

The NCC was asked to serve as consultants to the production of a series of videotapes entitled "Eat Well, Be Well," being produced by Amram Nowak Associates and funded by Metropolitan Life Insurance Company.

The "Eat Well, Be Well" series of 26 four and one-quarter minute videotape segments and 1 thirty-minute anthology, expresses up-to-date nutritional messages illustrated by recipe and menu suggestions. Each videotape presents in a practical and visually pleasing manner the scientific state-of-the-art and rationale behind the many aspects of the DHHS/USDA joint publication, Nutrition and Your Health, Dietary Guidelines for Americans.

On March 24, 1981, the entire series was beamed via satellite to the 225 PBS television stations across the country. To date, a number of responses received by the NIH from station and program managers of the PBS stations have indicated their enthusiasm to include this well done series on nutrition as part of their regular programming schedules. Many of the stations have already picked up the series that has now been seen by persons living in 48 of the 50 states. For example, Channel 13 in New York scheduled the "Eat Well, Be Well" series as part of its fall in-school programming. The entire series was aired two to three times specifically for classroom use. This scheduling allows teachers to base a nutrition lesson around each segment.

The reponses to the series have been excellent. For example, Mr. Rodney

Leonard, Executive Director of the Community Nutrition Institute in Washington, D.C., has commented:

> "Good creative visual materials are always difficult to find, and the 'Eat Well, Be Well' series is a rare blend of material presented with a brisk but never hurried pace. It is the most easily digestable series I have seen on nutrition and health, and with distribution, will contribute to better nutrition for all Americans."

In addition, Ms. Jane Brody made specific reference to the series in an article, "Personal Health: The Dangers of Nutritional Misinformation and Where to Get Trustworthy Advice," that appeared in the New York Times, on Wednesday, March 25, 1981. She refers to the series as "An excellent, yet brief series of up-to-date nutritional messages, illustrated by appropriate recipes and menu suggestions to be shown daily starting this week on PBS stations throughout the country."

In August 1981, the NCC exhibited the "Eat Well, Be Well" series at the XII International Congress of Nutrition held in San Diego, California. The exhibit, produced and manned by representatives from the Metropolitan Life Insurance Company, was visited by approximately 1,500 participants at the congress from around the world. Requests for copies of the series came from England, Australia, Canada, Africa, Mexico, and other countries. Representatives from industy, universities, and the media previewed and expressed an interest in the series.

In order to increase its marketability and promotion, the NCC has transformed the videotape series into 16 mm film that can be shown more easily at various schools, church organizations, clubs, etc. Plans for promoting the series include making it available, either as videotape or film, to the USDA Home Extension Service, the Society for Nutrition Education, and other interested agencies or organizations. Eight segments of the series will also be shown through a super 8 film cassette as part of a permanent free standing exhibit developed by the NCC to be displayed in the new Ambulatory Care Research Facility at the NIH.

This first "Eat Well, Be Well" series is an excellent example of successful joint industry and government cooperation in a nutrition education endeavor. Its success has helped to initiate a sequel, entitled "Eat Well, Be Well II," funded by Metropolitan Life Insurance Foundation in consultation with the NCC, and again being produced by Amram Nowak Associates. This second series is even more exciting as it exemplifies joint collaboration between industry, government and the scientific community. The sequel will consist of 14 videotape segments, 9 of which will feature prominent physicians from government, industry and the scientific community speaking on the role of nutrition in health and disease. The Secretary, DHHS, will be featured in one segment on "Exercise." This series will again feature Helen Hatton, demonstrating appropriate recipes, for each of the following topics covered in the sequel: vitamins and minerals; carbohydrates; prenatal diet; milk and dairy products (osteoporosis); dieting; protein (production of lean meat); body weight; alcohol; fiber; vegetarianism; food substitutions; ethnic foods; cholesterol; and exercise.

Conferences Sponsored by the NCC

The NCC mandate calls upon the NCC to sponsor conferences, workshops, and symposia in areas of nutrition research that are of concern to the Institutes.

The Conference on the Assessment of Nutritional Status

The Conference on the Assessment of Nutritional Status was held at the NIH on September 16-18, 1981. Approximately 130 scientists representing academia, industry, and government from the U.S., Canada, Egypt, England, Israel, and Jamaica participated. The objective of the conference was to highlight the current state of the art in the assessment of nutritional status. Emphasis was on currently available technology, its adequacy and shortcomings, and, most importantly, on the identification of research needs to develop adequate methods for nutritional assessment. Attention was given to the evaluation of the nutritional status of individuals, with emphasis on the low birth weight infant, the elderly, and hospitalized patients, including surgical patients. The ability of surveys to effectively identify population segments at risk, as well as trends in the nutritional status of the entire population and specific populations, were considered and extensively discussed.

The conference was cosponsored by three agencies of DHHS, the NIH Nutrition Coordinating Committee, the Centers for Disease Control, and the Food and Drug Administration, and marked the first step in the implementation of the Departmental Health Research Initiative in Nutrition. The Acting Director, NIH, Dr. Thomas Malone, opened the conference. The Secretary of the Department of Health and Human Services, the Honorable Richard Schweiker, gave the keynote address and formally inaugurated the Department's Health Research Initiative in Nutrition.

The conference consisted of six sessions. Session I, Assessment of Nutritional Status of the Individual, was cochaired by Drs. Victor Herbert and Van S. Hubbard. Session II, New Approaches to Methods for the Assessment of Nutritional Status of the Individual, was cochaired by Drs. Hamish N. Munroe and Theodore B. Van Itallie. Session III, Effects of Nutritional Status on Functional States, was cochaired by Drs. Jules Hirsch and Marian R. Yarrow. Session IV, Assessment of Nutritional Status in Epidemiological Studies and Surveys of Population, was cochaired by Drs. Alfred E. Harper and Milton Z. Nichaman. Session V, Recent Advances in Food Consumption Methodology, was cochaired by Drs. Gilbert E. Leveille and Allan L. Forbes. The last session, Session VI, Summary and Recommendations, was cochaired by Drs. Alfred E. Harper and Artemis P. Simopoulos. Selected papers presented at the conference have been published.*

The participants agreed that reliable methods for assessment of nutritional status are needed in order to: 1) determine whether or not impairment of health is the result of inadequate or inapropriate diet; 2) establish the specific nature of any nutritional problem underlying health impairment; 3) provide knowledge on which to base dietary treatments for improving health; and 4) permit evaluation of the effectiveness of nutritional treatments or interventions that may be undertaken to improve health.

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*Am. J. Clin. Nutr. 35: 1089-1325, 1982 (May Supplement)

The difficulties encountered in efforts to obtain reliable information about the nutritional status of both individuals and populations were emphasized frequently thoughout the conference. There are several reasons for these difficulties. Among them is the ability of the body to adapt under adverse conditions, so that changes in biochemical or functional characteristics become evident only after substantial impairment has occured. This requires that methods of assessment be both highly specific and highly sensitive. Also, the complexity of the interactions among dietary inadequacy, disease, and genetic and environmental variables makes it particularly difficult to establish whether health impairment is the result specifically of a nutritional problem or whether it is secondary to some other defect. These problems can be solved only through continuing basic research to expand knowledge of the patterns of biochemical, physiological, pathological, and behavioral responses to deficits or excesses of nutrients and to improve methods of applying this knowledge in practical situations.

Organizing Meeting for the Workshop on Body Weight, Health, and Longevity

As part of the Departmental Health Research Initiative in Nutrition, the NCC Chairman, on August 12, 1981, cochaired the meeting of the steering committee for the Workshop on Body Weight, Health, and Longevity that was held on January 25-26, 1982, at the NIH, cosponsored by the Centers for Disease Control and the NIH-NCC. The steering committee reviewed existing data and identified studies, pertinent to the workshop, that require critical review. The steering committee agreed that there is a need for such a workshop since:

- A general confusion exists about the terminology on desirable, ideal, and average weight tables
- Body weight tables based on life expectancy have not been proposed since 1959
- Metropolitan Life Insurance Company proposes to publish revised body weight tables in 1982
- New data in this area are available in the Build Study 1979, the American Cancer Society Study, the NCHS-HANES I and II, and the Framingham Heart Study.

Therefore, the steering committee proposed the following goals for the workshop:

- Update information relevant to the subject.
- Define the limits of reliability of data and their applicability

to health and longevity.

- Define the relationship of body weight to the life cycle (ultimately body weights must be related to body composition).
- Clarify and define terminology and concepts which are most applicable to practicing physicians and public health workers.
- Develop, through the International Union of Nutrition Scientists, uniform terminology and measurements that will help the field yield data with a common basis not only for the U.S. but throughout the world.

SUBCOMMITTEE ON NUTRITION EDUCATION ACTIVITIES AND ACCOMPLISHMENTS

In FY 1981 the Subcommittee on Nutrition Education reviewed various Institutes' nutrition publications intended for the public, put into motion the implementation plan for the Expanded Foods for Health Project, and developed a comprehensive program of nutrition activities to be carried out at the NIH during National Nutrition Month, March 1981.

Expanded Foods For Health Project

The subcommittee is implementing the Expanded Foods For Health Project. The project involves developing the scientific materials on a variety of nutrition topics as fact sheets with a unifying title and logo. These fact sheets will be made available to supermarkets and other interested groups throughout the country and their availability announced in the Federal Register. The Institutes participating in the program are NCI, NHLBI, NIA, NIADDK, NICHD and NIDR. The topics for the fact sheets include: "Food and Cancer" (NCI), "What You Eat May Help Control High Blood Pressure" and "Heart Healthy Eating Habits" (NHLBI), "Nutrition and the Later Years" (NIA), "Obesity" (NIADDK), "Infant Nutrition" and "Maternal Nutrition" (NICHD), and "Sugar and Tooth Decay" (NIDR).

National Nutrition Month at the NIH, March 1981

Each year the American Dietetic Association (ADA) sponsors nutrition related activities to designate March as the month to emphasize sound nutrition principles. In FY 1981 the NCC and the Subcommittee on Nutrition Education planned and coordinated a number of "National Nutrition Month" activities that took place at the NIH campus with the help of the NIH Jogging Club, the GSI Cafeteria Service, the Recreation and Welfare (R&W) Association, the Occupational Medical Service, and the NIH Credit Union. The staff of the NIH Record, OC/OD, and the Medical Arts Department assisted in publicizing all events.

The theme behind the NIH activities, "Nutrition and Your Health...Dietary Guidelines for Americans," was featured on posters and tent cards displayed on bulletin boards and in the cafeteria. The activities planned for March included: the distribution of the USDA/DHHS publication, Nutrition and Your Health, Dietary Guidelines for Americans; the NIH Recipe

Contest; "Fun Runs for Nutrition"; viewing of 10 "Eat Well, Be Well" segments and a film on obesity from the Medicine for the Layman Series; and a return visit by the NIH "Grocery Group." In addition:

- The Dietary Guidelines publication was distributed to all NIH personnel and made available at all R&W stores and Credit Union offices. The seven guidelines explained in the pamphlet attempt to advise healthy persons on ways to choose a good diet to maintain and perhaps even improve health.

- The NIH Recipe Contest was scheduled to judge all recipes submitted to the NCC office according to the principles established by the Dietary Guidelines. The criteria for entering the contest were as follows: 1) a recipe must be entered as a "main dish," "dessert" or "miscellaneous food"; 2) a brief (50 words or less) descrintion must accompany the recipe explaining how at least two dietary guidelines are put into practice; and 3) recipes will be judged on creativity and relation to the dietary guidelines. Persons were urged to keep in mind ways to get the most nutrition for the food dollar, and to share their ways to cut down on fat, cholesterol, sugar and salt.

- "Fun Runs for Nutrition" sponsored by the NIH Jogging Club and held weekly on four consecutive Fridays started off with a half-mile sprint and ended with a 3-mile cross-country run. Prior to the first run, a member of the President's Council on Physical Fitness and Sports gave a short informal presentation on the importance of a regular exercise program. Prizes donated by the R&W were awarded to all first and second place winners.

- The R&W sponsored a public demonstration on various forms of exercise for nonrunners that included the performance of a local aerobic dance group, a talk by a fitness specialist from the YMCA, and a viewing of the film "Game Plan For Survival" prepared by the President's Council on Physical Fitness and Sports. The exercises were geared to those who want to slim down and firm up, as well as to those who just want to keep in shape.

- Ten of the twenty-six videotapes of the "Eat Well, Be Well" series (previously described) were featured during National Nutrition Month, and shown in the NIH cafeterias in an exhibit on loan from the Metropolitan Life Insurance Company. These segments were also shown in some NIH buildings off the main campus through the closed circuit television system. The GSI Cafeteria Service offered at least one of the foods featured in the films as "Specials of the Day."

- Two additional films shown during the month were "Obesity" from the Medicine for the Layman series and "For Tomorrow We Shall Diet" shown by the Occupational Medical Services.

- The "NIH Grocery Group" returned to the Clinical Center as volunteers dressed in full costume as bananas, lettuce, tomatoes, bread, fish, etc., to visit the cafeterias and the pediatric ward. The group promoted sound nutrition principles while distributing copies of the *Dietary Guidelines*. The patients and NIH personnel found this return visit of the Grocery Group an entertaining culmination of the NIH's National Nutrition Month activities.

Miscellaneous Subcommittee Activities

The subcommittee began to work with the GSI Cafeteria Service, through the NIH Area Manager, to introduce more nutritious food selections as part of the regular NIH cafeteria service. The provision of nutrition information on foods regularly available in the cafeteria has been proposed to GSI by subcommittee members.

The subcommittee also intends to develop a publication for the general public on snacks considered appropriate by all the NIH Institutes. In order to avoid duplication of efforts and enhance the quality of the nutrition education materials destined for the public, the subcommittee plans to work closely with the nutrition education staff of the CNRU's. The subcommittee will serve also as a focal point for providing the CNRU Directors and staff with information on nutrition materials and resources available from the NIH and other agencies within the DHHS.

[illegible]

[illegible] Association Activities

The Association began to work with the [illegible] Children's Services [illegible]

The Association also plans to develop a publication for the general public [illegible] available from the NIH and other agencies [illegible]

[illegible]

III.

NUTRITION COORDINATING COMMITTEE OFFICE

The Nutrition Coordinating Committee office staff represents the NIH on a number of nutrition related committees involving other Federal agencies and departments, and the Office of Science and Technology Policy (OSTP) in the Executive Office of the President. In addition, the staff is primarily responsible for responding to information requests about nutrition in general and about the NIH nutrition program in particular.

ACTIVITIES OF THE NCC OFFICE

As in past years, in addition to staffing the NCC and its subcommittee, the NCC office responded to a great number and variety of requests for information on nutrition and the NIH nutrition program from the Congress, other Federal agencies, the scientific community, and the public. The major responsibilities of the NCC office were: to compile and analyze the data on the NIH nutrition program in order to develop the Annual Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training, "The Justification of Appropriations Estimates for Committee Appropriations" (Moyer Material on the NIH Nutrition Program), and the "Trans-NIH Nutrition Research Program" section of the report on NIH Extramural Programs; to collect and analyze data in preparing testimony and "special presentations" for the Office of the Director, NIH, and the Office of the Assistant Secretary for Health; to present the NIH nutrition program at national conferences and at meetings of professional societies; to assist the NIH Information Office with the preparation of press releases; and to provide input into DHHS nutrition activities.

The NCC Chairman represented the NIH at the DHHS Nutrition Coordinating Committee and at the USDA-DHHS Informal Coordinating Committee's quarterly meetings. The NCC Chairman serves as initiative coordinator of the Departmental Research Initiative in Nutrition. The NCC Chairman also cochairs and serves as the Executive Secretary of the Joint Subcommittee on Human Nutrition Research in the Office of Science and Technology Policy. The JSHNR first met in FY 1979 as evidence of the increased interest in nutrition research in the Executive Office of the President, the White House.

The NCC office has responded to information requests on nutrition, nutrition research, and the NIH Program in Biomedical and Behavioral Nutrition Research and Training from a broad spectrum of sources: the Congress, the Office of Technology Assessment, and the General Accounting Office; the Executive Branch, including the Office of Science and Technology Policy, the Office of Management and Budget, and various agencies of the Public Health Service; as well as from the scientific community and the public. The central focus provided by the office has undoubtedly facilitated NIH responses.

In order to expeditiously develop reports on each Institute's nutrition program and on the overall NIH Program in Biomedical and Behavioral Nutrition Research and Training, the NCC office maintains a computerized system for data retrieval on all nutrition research and training activities in the extramural and intramural programs at the NIH. This computerized data retrieval system was utilized to develop the tables and figures for this report as well as to respond to queries from Congress, the scientific community, and the public on an ad hoc basis.

Congressional Hearings on Nutrition

In FY 1981, the NCC office staff provided input to the following hearings:

The hearing on "The Food and Agriculture Act of 1981" was held March 19-20, 1981, before the Subcommittee on Department Operations, Research, and Foreign Agriculture of the House Committee on Agriculture. The DHHS witnesses included the Chairman of the NCC and representatives from CDC, NCHS, and FDA, who testified and answered questions regarding programs and activities in the area of nutrition research. The Chairman of the NCC presented the NIH Program in Biomedical and Behavioral Nutrition Research and described the activities of the Joint Subcommittee on Human Nutrition Research within OSTP, that is cochaired by DHHS and USDA.

The joint hearing on "International Marketing of Infant Formula" was held on June 16-17, 1981, before the House Committee on Foreign Affairs' Subcommittee on International Economic Policy and Trade, and the Subcommittee on Human Rights and International Organizations. The primary purpose of the hearing was to examine the rationale behind the negative vote of the U.S. on the implementation of the World Health Organization--UNICEF International Code for Marketing of Breast Milk Substitutes. The hearing provided a forum for the views of the administration, the infant formula industry, the scientific community, and the concerned public. In his testimony, the Assistant Secretary for Health, DHHS, affirmed the administration's commitment to the belief that breast milk is the best food for infants and that infant formula is an appropriate complement or substitute for women who cannot breastfeed. He testified that many questions on infant feeding practices and infant nutrition remain unanswered, including the question of whether there is "convincing evidence that advertising and marketing of formula are primary factors in the decline of breastfeeding in developing countries." The NCC Chairman served as a backup witness.

The hearing on "Infant Feeding Practices in the U.S." was held on June 22, 1981, before the Subcommittee on Domestic Marketing, Consumer Relations, and Nutrition of the House Committee on Agriculture. The purpose of this hearing was to discuss current programs, policies, and activities designed to encourage breastfeeding among mothers in the U.S. and to examine the reasons why breastfeeding is declining among poverty level and minority women. The Assistant Secretary for Health, DHHS, testified that the Department believes that infant formula is useful to women who do not breastfeed and it is the second best food for infants. He testified that the promotion of breastfeeding, as well as ensuring the quality and nutritional adequacy of infant formulas, and appropriate labeling of the infant formula containers are important public health priorities. The Chairman of the NCC accompanied the Assistant Secretary for Health at the hearing and responded to questions.

The hearing on "The Implementation of the Nutritional Status Monitoring System" was held on June 24, 1981, before the Subcommittee on Department Operations, Research and Foreign Agriculture of the House Agricultural Committee and the Subcommittee on Science, Research, and Technology of the House Science, Research and Technology Committee. The purpose of this hearing was to ascertain the administration's priorities and commitments relative to nutrition surveillance, monitoring and research. The Assistant Secretary for Health, DHHS, testified that DHHS would be the lead agency to implement the Nutritional Status Monitoring System

(NSMS) and that the nutrition intervention programs are not evaluated by such a system. As a result of the hearing it was decided that the final plan to implement the NSMS would have to be submitted to Congress by USDA and DHHS within 60 days of June 24, 1981. The NCC Chairman accompanied the Assistant Secretary for Health at this hearing.

Official Reports and Special Presentations on Nutrition

The NCC Office has provided input for reports on various nutrition issues prepared by other Federal agencies, as well as the General Accounting Office. In addition to numerous special reports the NCC office annually supplies data used in the preparation of the following four documents:

> "The Justification of Appropriation Estimates for Committee on Appropriations" (Moyer material on the NIH Nutrition Program), prepared by the NCC Office and the NIH Office of Communications at the request of the Labor-DHHS Appropriations Subcommittee of the House of Representatives, includes the financial obligations in nutrition of the PHS (NIH, FDA, CDC, HRA, ADAMHA) and the Office of Human Development, Administration on Aging, along with a description of each agency's nutrition program.
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> "The Program in Biomedical and Behavioral Nutrition Research and Research Training" section of the report on NIH Extramural Programs, which is a compendium of descriptions of all scientific programs supported by the B/I/D's. In addition to the nutrition program other trans-NIH programs described in the report include diabetes, arthritis, and digestive diseases.
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> "Federal Food, Agriculture, and Nutrition Programs" (FANI), developed by the General Accounting Office in cooperation with the USDA and the Office of Management and Budget, is an inventory report of 359 Federal programs in 28 different departments and agencies.
>
> "The DHHS Nutrition Information and Education Inventory," compiled by the DHHS-NCC Subcommittee on Nutrition Education, lists DHHS activities in the following three areas: nutrition education and information provided to the public; training programs for health professionals in the field of nutrition; and research in nutrition education.

Throughout the year, the NCC Chairman and office staff presented the NIH nutrition program and made special presentations on nutrition at the invitation of professional societies and other national and international groups interested in nutrition. In FY 1981 over 15 such presentations were made before national and international organizations such as the American Public Health Association, Association for Children and Adults with Learning Disabilities, XII International Congress of Nutrition, American Dietetic Association, and the American Medical Association, as well as before more specialized groups such as the NIH Grants Associate Program, the Joint Council on Food and Agricultural Sciences, and the National Cancer Advisory Board.

The NCC Office-Clinical Center Study on the Long-term Effect on Infants of Hypochloremic Metabolic Alkalosis Resulting from Infant Formulas Deficient in Chloride

In July 1979, a kidney specialist reported three cases of metabolic alkalosis in infants who were being fed only Neo-Mull-Soy, a soybean based formula deficient in chloride, an essential nutrient. Epidemiological work carried out by CDC found an additional 128 cases of infants who had at least one episode of metabolic alkalosis while being fed either Neo-Mull-Soy or Cho-Free, another soybean based formula deficient in chloride. (Metabolic alkalosis is an accumulation in the body of organic base compounds, such as blood bicarbonate, resulting in the derangement of the normal acid-base balance.) Analysis of formula preparations found that the products contained one-third the chloride stated on the product label and supplied approximately one-fifth the chloride recommended for infants by the American Academy of Pediatrics. The formulas were voluntarily recalled after having been on the market for about 16 months.

The NIH, at the recommendation of the NCC office, began a pilot study of infants with documented metabolic alkalosis secondary to feedings of formula deficient in chloride. In accordance with NIH policy, each child was admitted to the pilot study at the recommendation of his/her physician. The children are admitted to the study either as inpatients or outpatients. The study protocol includes a complete physical, neurological, and psychological examination along with detailed medical, social, and dietary histories. Special tests are selected in order to rule out other causes of metabolic alkalosis, especially Bartter's syndrome, which has symptoms similar to those observed in these infants.

A few affected infants were studied by their own physicians during the most severe phase of their illness. These infants are admitted as inpatients for 2 weeks to determine how they respond to a low, but adequate sodium level in their diet. Investigations are carried out to detect possible hormonal changes. None of the diagnostic tests are harmful to the infants and if any abnormalities are found, they will be further evaluated and treated.

Because only about 1 percent of the infants receiving the formulas developed hypochloremic metabolic alkalosis, the study is attempting to identify the factors that enhanced the infants' susceptibility to developing this metabolic alkalosis. Periodic reevaluations should reveal any long-term effects on growth and development of the metabolic alkalosis that resulted from ingesting only the chloride deficient formulas.

The present NIH study is a cooperative investigation with participation of the NICHD, NIADDK, NINCDS, the National Institute of Mental Health, and the NIH-NCC. The principal investigator is Dr. Van S. Hubbard (NIADDK), and associate investigators are Drs. Barry B. Bercu (NICHD), Charles C. Chang (NINCDS), Howard A. Moss (NIMH), and Artemis P. Simopoulos (NCC). Dr. Jose Cordero of the Bureau of Epidemiology of the Centers for Disease Control, Dr. Allan L. Forbes of the Food and Drug Administration, and Dr. Frederic C. Bartter of Audie Murphy Memorial Veterans Administration Hospital, San Antonio, Texas, served as consultants to the study.

On September 26, 1980, the Infant Formula Act of 1980 was signed by the President and became P.L. 96-359. Section 7(a) of the law states "The Secretary of Health and Human Services shall conduct a study to determine the long term effects on infants of hypochloremic metabolic alkalosis resulting from infant formula deficient in chloride. The Secretary shall report the results of such a study to the Congress."

In order to respond to the congressional mandate, a task force planned a series of two workshops. The first workshop, held March 19-20, 1981, included scientists with a background in neuroendocrinology, neurbsciences, metabolism, learning and behavior, as well as pediatricians and nephrologists who already have seen a number of children. The four major areas addressed by the participants at the workshop were:

1) define the population to be studied;

2) determine how to best do the study, i.e., expand the present study or develop a collaborative study with infants to be studied in other centers;

3) develop detailed protocols for the study; and

4) determine how long the children should be followed in order to determine the long-term effect on infants of hypochloremic metabolic alkalosis resulting from infant formulas deficient in chloride.

The second workshop, held April 21, 1981, included, in addition to the members of the task force, parents of children with hypochloremic metabolic alkalosis, representatives from the Infant Formula Council, representatives from Syntex, the producer of Neo-Mull-Soy and Cho-Free, and representatives from the Infant Formula Council.

The NCC Chairman continues to work with the task force for "The Clinical Center Study on the Follow-up of Hypochloremic Formula Feedings in Infants."

DHHS Nutrition Coordinating Committee/Policy Board and the Subcommittee on Nutrition Research and Research Training

The NIH-NCC Chairman continues to represent NIH at the DHHS/NCC and its Policy Board, and chairs the Subcommittee on Nutrition Research and Research Training. The NIH-NCC members and NCC staff also represent the NIH on the Food Safety Regulation, Nutrition Education, and International Nutrition Subcommittees.

DHHS Nutrition Research Initiative

In April 1978, the Secretary of the then Department of Health, Education and Welfare, initiated a major review and reappraisal of the Department's health research activities and long-term interagency research proposals.

In order to coordinate research planning and implementation, and thereby strengthen research, a steering committee consisting of representatives from the various agencies was established to define a number of health research initiatives. The initiatives were to focus on selected problem areas where mission needs of several DHHS agencies coincide with significant scientific opportunity. The health research principles approved by the Department in August 1979 were to serve as a basis in developing each initiative.

The NIH was designated as the sponsoring agency to develop the Nutrition Research Initiative, and the NCC Chairman was designated as coordinator. The agencies designated as cosponsors of the initiative were: The NIH-NCC; ADAMHA; FDA; CDC; the Office of Health Research Statistics and Technology, and NCHS-HANES. The impetus to develop this initiative in nutrition stemmed from the rapidly growing scientific interest, lively public debate on the pertinence of nutrition to particular health problems, and evolving Federal efforts to coordinate nutrition research at both policy and program levels.

The purpose of the nutrition initiative is to develop within the DHHS a more comprehensive and effective program of nutrition research and training to strengthen support of related missions. The principal thrust is to reinforce a coherent research program and to extend the growing trans-Institute cooperation in nutrition research to other DHHS agencies. A committee with members from the five agencies that conduct or support nutrition research and training are being given the task to develop a cohesive program for the Department in order to best carry out this initiative in nutrition research. This committee has the following responsibilities:

° Review and comment on the plans, execution, and results of research efforts, in order to refine and strengthen the Department's nutrition program;

° Coordinate research stemming from the obesity program, the CNRU's, nutrition research training and manpower development programs, and participation in OSTP's JSHNR;

° Provide information and advice on the nutrition research program to the directors of the agencies involved, to the Office of the Assistant Secretary for Health, and to the Office of the Secretary;

° Continuously evaluate research data and provide advice for the development of nutrition education materials for the public; and

° Plan and arrange for conferences, workshops, consensus development exercises, and reports as appropriate.

The Secretary, DHHS, inaugurated the Department's Health Research Initiative in Nutrition with his keynote address at the "Conference on the Assessment of Nutritional Status" held at the NIH on September 16-18, 1981. This conference is described in detail on pages 105-106 of this report. The second step in the implementation of the Initiative is the Workshop on Body Weight, Health, and Longevity, cosponsored by NIH-NCC and CDC. The steering committee for the workshop met in August 1981. (The workshop was held in January 1982.)

In addition to the conferences, work sponsored under the Nutrition Research Initiative includes the Joint PA, "NIH New Investigator Research Award (NIRA) in Nutrition: ADAMHA Special Notification for Research on Nutrition and Behavior" issued jointly by NIH and ADAMHA and described on page 26 of this report.

The Joint Subcommittee on Human Nutrition Research of the Federal Coordinating Council for Science, Engineering and Technology, Office of Science and Technology Policy, Executive Office of the President

The Committee on Health and Medicine (CHM) and the Committee on Food and Renewable Resources (CFRR) of the Federal Coordinating Council for Science, Engineering and Technology established the Joint Subcommittee on Human Nutrition Research because of the vital importance of the benefits from human nutrition research to the welfare of the American people and the world population, and the need for nutrition research efforts of the Federal agencies to be mutually reinforcing. The JSHNR is cochaired by representatives from DHHS and USDA. The Chairman, NCC, is the DHHS representative and serves as Cochairperson and Executive Secretary of the subcommittee. The Acting Chief Scientist, USDA, represents USDA on the subcommittee and serves as Cochairperson. In addition to DHHS, USDA, and OSTP (ex officio), seven other agencies are represented on the subcommittee: Department of Commerce, National Oceanic and Atmospheric Administration (DOC/NOAA); Department of Defense (DOD); Federal Trade Commission (FTC); International Development Cooperative Administration, Agency for International Development (IDCA/AID); National Science Foundation (NSF); and the Veterans Administration (VA). On March 11, 1980, the National Aeronautics and Space Administration (NASA) was asked to join the JSHNR.

The scope and the purpose of the subcommittee are as follows:

> Scope: The subcommittee is concerned with: (1) all Federally supported or conducted research on nutrition with emphasis on human nutrition; and (2) professional personnel needs in nutrition research and education.
>
> This includes:
>
> - Basic physiological and biochemical mechanisms for the digestion, absorption, metabolism, and transport of nutrients; the role of food ingredients in human health and performance and in the prevention and treatment of disease.
>
> - Nutrient composition of foods; the effects of storage, processing, and packaging; and the biological availability of nutrients in the foods at the time of consumption.

- Determinants of dietary practices and methods for educating the public about dietary practices.

- Food consumption patterns and nutritional status of the general population and of special high-risk subgroups within the population; evaluation of the nutritional impacts of various intervention strategies and public policies.

- The professional personnel to carry out research on human nutrition; training programs in nutrition research and nutrition education in medical schools, dental schools, schools for allied health professionals, schools of nutrition, teachers' colleges, and schools of food and agriculture; nutrition education at the primary and secondary school level; and the manpower needs for education of the public.

Purpose: The purpose of the JSHNR is to increase the overall effectiveness and productivity of research efforts in nutrition. In fulfilling this purpose, the subcommittee will:

a. Improve planning, coordination, and communication among Federal agencies engaged in research on nutrition.

b. Develop and update plans for Federal research programs to meet current and future domestic and international needs for nutrition.

c. Collect, compile, and disseminate information on nutrition research.

d. Prepare reports describing activities, findings, and recommendations of the subcommittee.

The Subcommittee issued its first report, Federally-Supported Human Nutrition Research, Training and Education: Update for the 1980's I. Human Nutrition Research and Training, on December 5, 1980. The report was issued as a supplement to the May 1981 issue of the American Journal of Clinical Nutrition. (Copies may be purchased by check or money order for $10.50 and copies on microfiche for $4.00 from the National Technical Information Service, [NTIS], 5285 Port Royal Road, Springfield, VA 22161 (Document Number PB81-128944).)

This report made the following recommendations for activities that the JSHNR should undertake in FY 1981:

1) Review the interdepartmental coordination in human nutrition research of its member agencies in greater depth, and make recommendations to simplify and strengthen the coordination, particularly at levels above that of specific programs.

2) Initiate development of a data base on all federally supported human nutrition research and research training activities (including intramural, extramural, collaborative, and formula grant

funded activities) in order to facilitate coordination, planning, and reporting.

3) Promote the development of joint workshops, conferences, and educational programs when appropriate.

4) Establish an annual meeting at which the directors of the NIH Clinical Nutrition Research Units, the intramural laboratories of USDA, NIH, and FDA, the VA clinical nutrition and alcohol research programs, and the managers of DOD and NASA programs with nutrition research components will discuss research progress and future research needs. Such discussions should lead to increased coordination and collaboration among the intramural programs of USDA, NIH, FDA, DOC, NASA, DOD, and VA. Furthermore it may indicate the need for the development of joint program announcements and requests for applications and proposals by USDA, NIH, FDA, NASA, and NSF. The JSHNR is uniquely qualified to determine specific needs for such joint action by cooperating agencies, and to assist in the development of mechanisms for implementation.

5) Complete by June 1981 the report on international nutrition research, and the report on nutrition education research, and nutrition education for professionals and for the public.

In FY 1981 in accordance with the fourth recommendation, the subcommittee began to plan the "Annual Conference of Federally-Supported Human Nutrition Research Units--An Information Exchange Activity of the JSHNR" in order to increase coordination and collaboration regarding nutrition research and training activities. This first meeting is scheduled for December 16-17, 1982, in Washington, D.C.

The subcommittee has completed the two additional reports Federally-Supported Human Nutrition Research, Training and Education: Update for the 1980s. II. International Nutrition Research and III. Nutrition Education Research and Professional Personnel Needs for Nutrition Education of Professionals and the Public, which were published in June 1982. These reports are available from NTIS (see above) as reports number PB82-231739 and PB82-231747, respectively. This completes the first series of reports to be published by the subcommittee.

In addition to the reports, the subcommittee has developed a nutrition research, training, and education classification system for data retrieval. When this system is implemented, the U.S. Government will have an up-to-date computerized data retrieval system in nutrition for the first time. Such a system is essential for planning nutrition research and training by the Federal Government.

their activities in order to facilitate coordination, planning, and reporting.

3) [illegible] the development of joint workshops, conferences, and exchanges [illegible] when appropriate.

4) Establish an [illegible] among the directors of the NIH Clinical Nutrition Research Units, the intramural laboratories of USDA, NIH and [illegible], the [illegible] centers and alcohol research programs, and the [illegible] NASA program [illegible] research needs [illegible] should [illegible] the intramural [illegible] of USDA, NIH, FDA, DOD, NASA, VA, and AID. Furthermore it may [illegible] the need for the development of joint program announcements and requests for applications and proposals by USDA, NIH, [illegible] and [illegible] specific [illegible] cooperating agencies, and to assist [illegible] for implementation.

5) Complete [illegible] the reports [illegible] nutrition research, and the report on nutrition education research, and nutrition education for professionals and for the public.

In FY 1981 in accordance with the fourth recommendation, the subcommittee began to plan the "Annual Conference of Federally-Supported Human Nutrition Research Units and Centers" [illegible] in order to increase coordination and collaboration regarding nutrition research and training activities. This first meeting is scheduled for December [illegible] 1982, in Washington, D.C.

The subcommittee has completed the two additional reports "Federally-Supported Human Nutrition Research [illegible] Training [illegible]" [illegible] nutrition education research [illegible] for professionals and the public [illegible]. These reports are available [illegible] respectively. This completes the third series of reports [illegible] by the subcommittee.

In addition to the reports, the subcommittee has developed a nutrition research, training, and education classification system [illegible]. When this system is implemented, the U.S. [illegible] would have an up-to-date computerized data retrieval system in nutrition for the first time. Such a system [illegible] research and training [illegible] the Federal Government.

IV.
APPENDICES

APPENDIX A

NUTRITION POLICY OF THE NIH

Policy Objectives:

The NIH supports DHHS policy by sponsoring and conducting biomedical research designed to improve the quality of life for all Americans through optimal nutrition. Basic biomedical nutrition research will develop knowledge needed to promote and maintain health, as well as to prevent and treat disease.

Nutrition research has passed through two stages and is now entering a third. The first stage saw the discovery of vitamins and the development of many of the basic nutritional requirements. The second stage reduced nutrition to subcellular and molecular terms within areas of biochemistry and physiology. The third stage calls for a synthesis of newer findings for translation into practical information to assist the individual to develop normally, to avoid disease, and to live as long and as healthy a life as possible. For this third stage, knowledge is needed that will permit distinction among individuals in terms of genetic differences that affect dietary requirements.

Areas of Emphasis:

Current nutrition research at NIH concentrates on eight critical areas:

1. Clinical Nutrition Throughout the Life Cycle. Research in this initial area examines variations in nutritional requirements to promote and maintain health during all phases of the life cycle. Within the clinical nutrition program, research is also directed towards elucidating the effects of infant feeding practices and infant nutrition on subsequent physiological, immunological, and mental development. Another research goal involving the life cycle is to understand the effects of maternal nutritional status and maternal diet before and during pregnancy on the development of the fetus. In order to understand the ramifications of this nutritional problem, more must be learned about the interaction between the genetic makeup of an individual and his dietary intake. Special emphasis is given to studies on the role of nutrition in health of the aged and aging process, particularly the effects of aging on nutrient utilization, digestion, absorption, and metabolism, and nutrition and age-related mental deterioration.

2. Role of Nutrition in Disease Development. The NIH conducts research on mechanisms by which dietary deficiencies, imbalances, and excesses lead to the development of physical and mental diseases and disorders.

3. Prevention of Disease. The NIH has assumed a leading role in shifting the emphasis in nutrition research from curing disease after symptoms have developed to preventing or delaying the onset of disease. Continued research emphasis is given to malnutrition in all its guises, including under- and over-nutrition, obesity, food faddism, and specific dietary deficiencies.

4. Treatment of Disease. The NIH develops nutritional therapies for specific diseases, such as cancer, gastrointestinal disorders, obesity, osteoporosis, renal insufficiency, atherosclerosis, and inborn errors of metabolism. Improved methods are being developed to provide general nutritional support for newborns of low birth weight who may require parenteral supplementation and for elderly, disease-ridden, traumatized, or post-operative patients who may require total parenteral nutrition or elemental diets.

5. Technology Transfer. An important component of the NIH nutrition policy is to assure appropriate application of research in practice. To expedite transfer of nutrition technology, the NIH is establishing mechanisms to evaluate research data relevant to nutrition and public health.

6. Nutrition Education. The NIH continues to support research in nutrition education as by-products of clinical trials and demonstration projects; by the education of the physician through professional societies, scientific meetings, and journals; and by the production of nutrition education materials for the health educator and the public. Encouragement of positive nutrition behavior is an obvious task for educators of children, young adults, and the elderly.

7. Research Training. The NIH encourages and supports the teaching of modern biochemical nutrition at the pre- and postdoctoral levels. This training includes the disciplines upon which nutrition research is based, such as gastroenterology, endocrinology, metabolism, developmental biochemistry, genetics, and molecular biology. The NIH also promotes expanded training programs in basic and clinical nutrition research aimed principally at the physician investigator and clinically oriented biomedical scientists.

8. Coordination. The NIH cooperates in establishing mechanisms for interagency coordination. Nutrition research at the NIH is coordinated through the Nutrition Coordinating Committee. Institutes initiate their own nutrition programs within their appropriated budgets. The committee seeks agreement on critical issues of definition, comments upon individual programs identified to it, maintains an information exchange (mechanisms for program development), promotes liaison with other Federal agencies, and encourages coordinated program planning among Institutes and with other appropriate agencies. The Committee assists in the development of nutrition data retrieval systems, and reviews legislative and regulatory initiatives that impact upon human nutrition research.

APPENDIX B

MANDATE OF THE NIH NUTRITION COORDINATING COMMITTEE

The Nutrition Coordinating Committee:

- Reviews and comments on the plans, execution, and results of pertinent Bureau, Institute, and Division research efforts relating to nutrition in order to develop the Annual Report of the NIH Program in Biomedical and Behavioral Nutrition Research and Training.

- Processes and responds to incoming requests for nutrition information from the DHHS and other Federal agencies, the Executive Branch of the Government, the Congress, outside institutions, and the public.

- Maintains up-to-date information on funding and on intramural and extramural research and training activities in nutrition.

- Develops and monitors means for improving the coordination of these activities.

Within the scope of the major activities described above, the NCC has the following specific functions:

- To define nutrition research at the NIH. (Accomplished, see page 3.)

- To develop a policy statement for research and training in nutrition at the NIH. (Accomplished, see page 125.)

- To establish information exchange. Each representative presents to the NCC any new plans, activities, conferences, and workshops that are concerned with nutrition. Future workshops and conferences are discussed to ensure full participation of all relevant Institutes; when many Institutes are involved, the NCC sponsors or cosponsors such workshops or conferences. Through the information exchange mechanism, the NCC identifies areas of collaboration for further research. The NCC informs the NIH nutrition community of all meetings, both within and outside NIH, concerned with nutrition. The committee, if requested, also reviews and comments on nutrition reports generated by the NIH and by other Federal and non-Federal agencies.

- To develop a data retrieval system for research and training in nutrition. (Accomplished, see page 5.)

- To review proposed legislation and regulations. The NCC develops mechanisms for receiving, reviewing, and distributing information on proposed legislation affecting nutrition policy.

- To develop and maintain effective liaison with other departments and agencies that have nutrition activities. The NCC assesses existing liaison mechanisms and identifies those departments and agencies requiring a liaison relationship. Liaison representatives provide information to the NCC.

- To encourage the application of nutrition research to practice. The NCC members identify research data that are ready for "technology transfer" and promote the appropriate application of new knowledge in nutrition.

- To promote the dissemination of information for the purpose of public education on the role of nutrition on health and disease. The NCC assists in coordinating Bureau, Institute, and Division efforts in nutrition education and acts as a focal point for the dissemination of nutrition information to the public.

APPENDIX C

FY 1981 NUTRITION EXPENDITURES BY INSTITUTE AND DIVISION

Table C-1

National Cancer Institute
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981

(in thousands of dollars)

		Breakdown		Total	
	Item	Number	Cost	Number	Cost
Extramural					
Research grants:	Regular	259	$13,338		
	Clinical trials	103	850		
	Total			362	$ 14,188
Program projects:	Regular	21	3,427		
	Clinical trials	2	529		
	Total			23	3,956
Contracts:	Regular	86	6,319		
	Clinical trials	8	375		
	Total			94	6,694
Centers:	Regular	26	1,779		
	Clinical trials	0	0		
	Total			26	1,779
Research support				0	0
Reimbursement agreements				7	677
Training:	Training grants	6*	270		
	Fellowships	1*	19		
	Total			7*	289
Research Career Development Awards				6*	221
New and Academic Investigator Awards				9*	149
Subtotal - Extramural					$ 27,952
Intramural					
Projects				27	2,360
Training				0*	0
Subtotal - Intramural					$ 2,360
TOTAL NUTRITION RESEARCH AND TRAINING - NCI					$ 30,313

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*Number of persons.

Table C-2

National Heart, Lung, and Blood Institute
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

	Item	Breakdown		Total	
		Number	Cost	Number	Cost
Extramural					
Research grants:	Regular	158	$14,385		
	Clinical trials	2	1,394		
	Total			160	$15,779
Program projects:	Regular	12	3,156		
	Clinical trials	0	0		
	Total			12	3,156
Contracts:	Regular	10	524		
	Clinical trials	50	8,180		
	Total			60	8,704
Centers:	Regular	13	4,348		
	Clinical trials	0	0		
	Total			13	4,348
Research support				0	0
Reimbursement agreements				7	454
Training:	Training grants	50*	1,165		
	Fellowships	3*	42		
	Total			53*	1,207
Research Career Development Awards				5*	158
New and Academic Investigator Awards				11*	278
Subtotal - Extramural					$34,084
Intramural					
Projects				11	1,016
Training				6*	114
Subtotal - Intramural					$ 1,130
TOTAL NUTRITION RESEARCH AND TRAINING - NHLBI					$35,214

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*Number of persons

Table C-3

National Institute of Dental Research
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

	Item	Breakdown		Total	
		Number	Cost	Number	Cost
Extramural					
Research grants:	Regular	9	$ 547		
	Clinical trials	0	0		
	Total			9	$ 547
Program projects:	Regular	1	80		
	Clinical trials	0	0		
	Total			1	80
Contracts:	Regular	5	266		
	Clinical trials	0	0		
	Total			5	266
Centers:	Regular	1	209		
	Clinical trials	0	0		
	Total			1	209
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	10*	186		
	Fellowships	2*	54		
	Total			12*	240
Research Career Development Awards				1*	33
New and Academic Investigator Awards				3*	80
Subtotal - Extramural					$ 1,455
Intramural					
Projects				3	48
Training				0*	0
Subtotal - Intramural					$ 48
TOTAL NUTRITION RESEARCH AND TRAINING - NIDR					$ 1,503

*Number of persons.

Table C-4

National Institute of Arthritis, Diabetes, and Digestive and Kidney Diseases
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

		Breakdown		Total	
	Item	Number	Cost	Number	Cost
Extramural					
Research grants:	Regular	420	$20,923		
	Clinical trials	0	0		
	Total			420	$20,923
Program projects:	Regular	12	2,849		
	Clinical trials	0	0		
	Total			12	2,849
Contracts:	Regular	10	380		
	Clinical trials	0	0		
	Total			10	380
Centers:	Regular	6	2,448		
	Clinical trials	0	0		
	Total			6	2,448
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	53	793		
	Fellowships	17	251		
	Total			70*	1,044
Research Career Development Awards				6*	192
New and Academic Investigator Awards				17*	570
Subtotal - Extramural					$28,406
Intramural					
Projects				23	2,414
Training				8*	86
Subtotal - Intramural					$ 2,500
TOTAL NUTRITION RESEARCH AND TRAINING - NIADDK					$30,906

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*Number of persons.

Table C-5

National Institute of Neurological and Communicative Disorders and Stroke
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

	Item	Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	33	$ 1,448		
	Clinical trials	0	0		
	Total			33	$ 1,448
Program projects:	Regular	1	61		
	Clinical trials	0	0		
	Total			1	61
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	1	50		
	Clinical trials	0	0		
	Total			1	50
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	0*	0		
	Fellowships	0*	0		
	Total			0*	0
Research Career Development Awards				0*	0
New, Young, and Academic Investigator Awards				0*	0
Subtotal - Extramural					$ 1,559
Intramural					
Projects				0	0
Training				0*	0
Subtotal - Intramural					$ 0
TOTAL NUTRITION RESEARCH AND TRAINING - NINCDS					$ 1,559

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*Number of persons.

Table C-6

National Institute of Allergy and Infectious Diseases
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

	Item	Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	22	$ 1,401		
	Clinical trials	0	0		
	Total			22	$ 1,401
Program projects:	Regular	1	31		
	Clinical trials	0	0		
	Total			1	31
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	4*	10		
	Fellowships	0*	0		
	Total			4*	10
Research Career Development Awards				0*	0
New and Academic Investigator Awards				1*	43
Subtotal - Extramural					$ 1,485
Intramural					
Projects				1	77
Training				0*	0
Subtotal - Intramural					$ 0
TOTAL NUTRITION RESEARCH AND TRAINING - NIAID					$ 1,562

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*Number of persons.

Table C-7

National Institute of General Medical Sciences
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

		Breakdown		Total	
	Item	Number	Cost	Number	Cost
Extramural					
Research grants:	Regular	11	$ 807		
	Clinical trials	0	0		
	Total			11	$ 807
Program projects:	Regular	2	328		
	Clinical trials	0	0		
	Total			2	328
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	3	766		
	Clinical trials	0	0		
	Total			3	766
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	92*	473		
	Fellowships	0*	0		
	Total			92*	473
Research Career Development Awards				2*	79
New and Academic Investigator Awards				2*	50
Subtotal - Extramural					$ 2,503
Intramural					
Projects				0	0
Training				0*	0
Subtotal - Intramural				0	0
TOTAL NUTRITION RESEARCH AND TRAINING - NIGMS					$ 2,503

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*Number of persons.

Table C-8

National Institute of Child Health and Human Development
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

	Item	Breakdown Number	Breakdown Cost	Total Number	Total Cost
Extramural					
Research grants:	Regular	152	$10,836		
	Clinical trials	5	531		
	Total			157	$11,367
Program projects:	Regular	16	4,115		
	Clinical trials	3	240		
	Total			19	4,355
Contracts:	Regular	2	381		
	Clinical trials	0	0		
	Total			2	381
Centers:	Regular	17	1,223		
	Clinical trials	3	33		
	Total			18	1,256
Research support				1	11
Reimbursement agreements				1	8
Training:	Training grants	19*	247		
	Fellowships	4*	84		
	Total			23*	331
Research Career Development Awards				8*	244
New and Academic Investigator Awards				2*	92
Subtotal - Extramural					$18,045
Intramural					
Projects				10	1,563
Training				11*	500
Subtotal - Intramural					$ 2,063
TOTAL NUTRITION RESEARCH AND TRAINING - NICHD					$20,108

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*Number of persons.

Table C-9

National Eye Institute
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

	Item	Breakdown		Total	
		Number	Cost	Number	Cost
Extramural					
Research grants:	Regular	64	$ 2,837		
	Clinical trials	3	431		
	Total			67	$ 3,268
Program projects:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	1	6		
	Clinical trials	0	0		
	Total			1	6
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	0*	0		
	Fellowships	5*	68		
	Total			5*	68
Research Career Development Awards				5*	35
New and Academic Investigator Awards				3*	57
Subtotal - Extramural					$ 3,434
Intramural					
Projects				7	831
Training				0*	0
Subtotal - Intramural					$ 831
TOTAL NUTRITION RESEARCH AND TRAINING - NEI					$ 4,265

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*Number of persons.

Table C-10

National Institute of Environmental Health Sciences
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

	Item	Breakdown		Total	
		Number	Cost	Number	Cost
Extramural					
Research grants:	Regular	23	$1,373		
	Clinical trials	0	0		
	Total			23	$ 1,373
Program projects:	Regular	1	453		
	Clinical trials	0	0		
	Total			1	453
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Research support				0	0
Reimbursement agreements				0	0
Training:	Training grants	0*	0		
	Fellowships	0*	0		
	Total			0*	0
Research Career Development Awards				0*	0
New and Academic Investigator Awards				3*	120
Subtotal - Extramural					$ 1,946
Intramural					
Projects				1	160
Training				0*	0
Subtotal - Intramural					$ 160
TOTAL NUTRITION RESEARCH AND TRAINING - NIEHS					$ 2,106

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*Number of persons.

Table C-11

National Institute on Aging
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

	Item	Breakdown		Total	
		Number	Cost	Number	Cost
Extramural					
Research grants:	Regular	38	$ 2,349		
	Clinical trials	0	0		
	Total			38	$2,349
Program projects:	Regular	7	$ 690		
	Clinical trials	0	0		
	Total			7	$ 690
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Research support				0	0
Reimbursement agreements				1	180
Training:	Training grants	34*	16		
	Fellowships	4*	32		
	Total			38*	48
Research Career Development Awards				1*	20
New and Academic Investigator Awards				13*	122
Subtotal - Extramural					$ 3,409
Intramural					
Projects				12	724
Training				0*	0
Subtotal - Intramural					$ 724
TOTAL NUTRITION RESEARCH AND TRAINING - NIA					$ 4,133

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*Number of persons.

Table C-12

Division of Research Resources
BIOMEDICAL AND BEHAVIORAL NUTRITION RESEARCH AND TRAINING, FY 1981
(in thousands of dollars)

	Item	Breakdown		Total	
		Number	Cost	Number	Cost
Extramural					
Research grants:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Program projects:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Contracts:	Regular	0	0		
	Clinical trials	0	0		
	Total			0	0
Centers:	Regular	24	1,205		
	Clinical trials	0	0		
	Total			24	1,205
Research support:	Regular	257	12,778		
	Clinical trials	2	347		
	Total			259	13,125
Reimbursement agreements				0	0
Training:	Training grants	0*	0		
	Fellowships	0*	0		
	Total			0*	0
Research Career Development Awards				0*	0
New and Academic Investigator Awards				0*	0
Subtotal - Extramural				$	14,330
Intramural					
Projects				0	0
Training				0*	0
Subtotal - Intramural				$	0
TOTAL NUTRITION RESEARCH AND TRAINING - DRR				$	14,330

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*Number of persons

**A percentage of this is clinical trials

APPENDIX D

NIH FY 1983 PRIORITIES IN NUTRITION RESEARCH AND RESEARCH TRAINING

The FY 1983 priorities in nutrition research and research training are described below, by Institute and Division.

National Cancer Institute

At the NCI, nutrition priorities include studies on the maintenance of the nutritional status of patients with cancer; the role of diet and nutrition in cancer etiology; host-tumor interactions and competition for nutrients; the formulation of prevention strategies based upon diet and nutrition; and the role of diet and nutrition in the rehabilitation of patients with cancer. An additional priority for the NCI is the dissemination of information derived from cancer and nutrition studies. In December 1980, the Diet, Nutrition, and Cancer Program sponsored a workshop on the special nutritional needs of pediatric cancer patients and the proceedings of that workshop are being published.

The development of techniques and procedures to maintain the nutritional status of well-nourished cancer patients and to improve the nutritional status of malnourished cancer patients is of highest priority in the area of cancer therapy. This research program includes the development of techniques and procedures to assess the nutritional status of cancer patients at diagnosis and followup through treatment; the evaluation of existing products and procedures used in the nutritional support of cancer patients; and the development of improved formulations and delivery systems in total parenteral nutrition, total enteral nutrition, and oral supplementation. Research on techniques and procedures to assess nutritional status has 1) documented the utility and limitations of anthropometry, 2) demonstrated the value of the computerized tomography (CT) scan for assessing nutritional status and body composition, 3) shown no advantage for ultrasound over anthropometry, and 4) demonstrated the prominence of muscle wasting in the weight loss of cancer patients. These procedures are now being applied in studies of nutritional support of cancer patients. Studies of energy expenditure using whole body calorimetry are currently in progress and will further define the nutritional needs of the cancer patient. This program also includes the evaluation of alternative procedures for maintaining nutritional status, such as behavior modification, biofeedback, and development of drugs to improve appetite.

Research on the role of diet and nutrition in cancer etiology involves the assessment of nutritive and nonnutritive dietary components as carcinogens and procarcinogens, their interactions in carcinogen metabolism, and the relative hazard levels of appropriate substances. Foods and food additives are being examined for their possible carcinogenic effects, and nutrients are being studied for their possible role as inhibitors of the action of chemical carcinogens.

Studies of basic mechanisms involve nutrient uptake and utilization and cellular control mechanisms in both normal and neoplastic tissues.

Epidemiological surveys to develop hypotheses for testing in laboratory and animal studies and to assess potential and relative hazards of foodborne carcinogens and procarcinogens are also included.

The issues of food preparation and processing require research priority as do food additives, supplements, and vitamins. Risks related to nutritive and nonnutritive components, especially in certain populations, are also included. The roles of alcohol, fat, fiber, and obesity in cancer will also be further defined. Studies will also include the effects of dietary factors on cancer and the immune system.

Studies on host-tumor interactions and the competition for nutrients are designed to develop more complete understanding of tumor growth and differentiation as they affect the metabolism of the host. Such research involves the separate evaluation of the nutritional requirements of host and neoplasia. An understanding of growth requirements and control mechanisms will allow the formulation of new therapy schemes based on differential nutrient availability. Many chemotherapeutic agents now in use act as metabolic antagonists or blocking agents, or they create overt nutritional deficiencies. The use of nutritionally modified enteral or parenteral nutrition solutions allows for the development of new therapy protocols. This program also investigates the role of tumor metabolism and excretory products in controlling food intake and nutrient metabolism in the host. Research on the development of pharmacologic agents to increase food intake in cancer patients has been conducted. Other research will be done on special nutritional needs of the various age levels of cancer patients, i.e., children, adolescents, adults, elderly.

A fourth priority area for the NCI is concerned with the formulation of prevention strategies based on diet and nutrition to minimize cancer incidence or recurrence. Techniques and procedures to assess the nutritional status of individuals are being developed; such assessments are useful in prevention activities. Epidemiological investigations of dietary habits and nutritional status on tumor incidence and patient survival are under way in different populations. It is evident from epidemiological studies that dietary and lifestyle factors play a major role in cancer risk. Prevention strategies can thus be developed to minimize such risk, based upon dietary, nutritional, and lifestyle factors of various populations, without knowing every detail of the etiological process. This program evaluates the evidence from epidemiological, clinical, laboratory, and animal studies in order to develop prevention strategies for testing and validation. It includes the development and validation of methodologies to evaluate the cost-effectiveness of specific and alternative prevention strategies and the study of nutritional agents which can serve in the chemoprevention of cancer. Where appropriate, research will develop and evaluate procedures for creating educational programs for health professionals and for the public. NCI will explore the possibility of intervention trials assessing various dietary factors in the occurrence of certain malignancies such as colon and breast cancer in high risk populations.

The role of diet and nutrition in the rehabilitation of the cancer patient is a priority, since the nutrition rehabilitation of the cured cancer patient is important in maximizing the quality of life and in returning the patient to a productive life. Through clinical trials, the effectiveness of nutritional support in cancer patients will be evaluated. Research in this area includes the maximization of quality of life.

The program includes the evaluation of nutritional requirements during remission, the nutritional rehabilitation process, and the evaluation of dietary and nutritional factors on maximizing patient survival. Since current therapy often creates nutritional problems (patients with ostomies, shortened gastrointestinal tracts, pancreatectomies, etc.), the special requirements of these individuals will be considered. It is important that valid and useful information on the role of diet and nutrition in cancer etiology, prevention, treatment, and rehabilitation be disseminated to health care professionals and to the public. The NCI program includes the development of educational and informational materials and programs, as well as their dissemination. Also included are workshops, seminars, symposia, demonstration projects, information transfer networks, publications of various types, and research into the most effective dissemination procedures.

The NCI is presently funding two Clinical Nutrition Research Units.

National Heart, Lung, and Blood Institute

The NHLBI has several priorities in nutrition research: studies on the role of nutrition in arteriosclerosis; the operation of the Arteriosclerosis Specialized Centers of Research; continuation of community-based media intensive education field trials for cardiovascular health; basic and clinical research at the Research and Development Center for Heart and Vascular Disease; studies on the nutritional aspects of lipid diseases, conducted at the Lipid Research Clinics; research on dietary intervention through the Multiple Risk Factor Intervention Trial; the development of comprehensive tables of food composition; studies on the alteration of diet through behavioral modification; investigations concerning the effects of diet on the metabolism, structure, composition, and blood levels of high-density lipoproteins and other lipoproteins; the implementation of heart attack prevention through nutrition counseling; the analysis of nutrient composition of foods; studies on the effects of maternal nutrition on infantile respiratory distress syndrome; and research concerning the role of nutrition in hypertension.

Studies on the role of nutrition in arteriosclerosis and its sequelae are supported by research grants. Specific areas of study include: the effect of diet on blood lipids and lipoproteins, the effect of diet on coronary heart disease morbidity and mortality, dietary implications of the exacerbating effects of diabetes and hypertension on arteriosclerosis, the basic mechanisms whereby excessive sodium contributes towards hypertension, and the effects of vitamin and mineral nutrition on thrombus formation. Studies on blood platelets and arteriosclerosis will consider the structural and functional effects of dietary modifications on platelet-arterial wall interaction with emphasis on the role of arterial wall prostacycline, platelet thromboxane, and their inhibition.

The Arteriosclerosis Special Centers of Research are concerned with particular components of human and animal diet in relationship to hyperlipidemia and to the etiology of arteriosclerosis and coronary heart disease. Several of the centers are involved in studies to determine the extent to which dietary manipulations can prevent or modify risk factor development in humans.

The community-based media intensive education field trial for cardiovascular health is an NHLBI program designed to prevent coronary heart disease by behavioral modification of selected populations. Dietary intervention is directed through the media and small group instruction to induce dietary reduction in the intakes of cholesterol, saturated fat, calories, and salt. The nutrition-associated goals include lowering levels of plasma cholesterol, triglycerides, and high-density lipoprotein; reduction in blood pressure; correction of obesity; and the promotion of physical activity.

The Research and Demonstration Center for Heart and Vascular Disease has as its mission the development and conduct of basic and clinical research treatment protocols for heart and vascular disease. The program is implemented through community clinics and other forms of community outreach. Specific nutrition aspects include: 1) cooperative efforts with local restaurants in which nutritious, low-cholesterol meals are designed, included on menus, and advertised to the public; 2) attempts to alter dietary habits (with the cooperation of the County Extension Service), particularly among blacks in the lower socioeconomic group since they are at high risk for cardiovascular disease; and 3) the distribution of Spanish-language heart-health publications, such as the "Help Your Heart Eating Plan" designed especially for the large Spanish-speaking population in the greater Houston area.

Longitudinal studies of coronary heart disease risk factors in the young will measure changes in risk factors (e.g., blood lipids and lipoproteins, blood pressure, adiposity, blood sugar, etc.) that have been associated with the development of coronary heart disease cohorts of males and females ranging in age from newborn to 30 years.

Through its Lipid Research Clinics, the NHLBI supports nutrition research in two related programs. The first of these is an internationally based study of the prevalence of dyslipidemias in defined populations, which aims to describe the influences on lipid transport diseases. The second is a trial involving more than 3,800 men between 35 and 59 years of age to test whether lowering cholesterol in hypercholesterolemic subjects will reduce or slow the development of premature coronary heart disease. An important component of this study is a Food and Nutrition Resource Center, which serves the whole program.

The Multiple Risk Factor Intervention Trial tests whether intervention in a group of 12,000 men, 35 to 54 years old, who are at above-average risk of death from coronary disease, can yield a 50 percent reduction in mortality. The nutrition intervention component of this clinical trial is designed to bring about changes in eating habits to achieve a reduction in serum cholesterol; and to control hypertension through weight control and sodium restriction.

An additional priority area for the NHLBI is the development of comprehensive tables of food composition. The Institute has a collaborative program with the Department of Agriculture to underwrite the acquisition of certain nutrient data that will not only serve the needs of the NHLBI, but also benefit the entire nutrition community. The Institute also supplies funds to the USDA Nutrient Composition Laboratory to pursue development of automated analytic techniques for direct analysis of food.

Another NHLBI priority is concerned with research on the effects of diet on the metabolism, structure, composition, and blood levels of high-density lipoproteins and other lipoproteins. Lipoproteins carry cholesterol, and recent epidemiological studies have found that high-density lipoprotein levels are associated with a reduced risk for coronary heart disease. The aim of research in this area is to develop fundamental information regarding the effect of diet on lipoproteins, including investigations into long-term dietary influences, dietary control mechanisms, and the steady-state levels under various caloric intakes. The Division of Blood Diseases and Blood Resources is investigating the role of dietary lipids in hemostasis and thrombosis with regard to platelet lipids and changes in the functional activity of platelets.

The implementation of heart attack prevention through nutrition counseling is another NHLBI priority. The Regional Training Workshops for Nutrition Counseling in Hyperlipidemia for Dietitians and Nutritionists aim to stimulate interest in improving nutrition counseling skills at the level of the local practicing health professional through the presentation of 1-day regional workshops.

Research on the infantile respiratory distress syndrome (RDS) is a priority area since RDS is the single most frequent cause of death during the neonatal period. A small but important fraction of the risk concerns maternal nutrition, which, along with steroid therapy, is being studied as a means of reducing the risk of premature birth and consequent risk of RDS.

The role of nutrition in hypertension and its sequelae is an additional priority for the NHLBI. One of the current projects is the National High Blood Pressure Education Program which aims to develop means of providing better management of high blood pressure through a collaborative effort with the private sector, other Federal agencies, and state health departments through the education of health professionals, patients, and consumers. Because of the role that salt and weight play in the genesis, management, and treatment of many forms of hypertension, efforts are directed toward reducing overweight and controlling sodium intake in patients with high blood pressure.

Research on ways to control hypertension also takes place at the work site. Three studies are looking at the effectiveness of different intervention techniques for hypertension control in the work setting as indicated by changes in employee health status at the end of a 24-30 month period. The intervention techniques studied include a general education program about high blood pressure, its consequences, and treatment; a detection program to identify those persons at risk of high blood pressure; and a specific education program that includes dietary counseling for those persons identified as being at risk.

Another program, the Dietary Intervention Study of Hypertension, consists of three centers cooperating in a clinical trial to assess the effectiveness of diet therapy (weight control and/or sodium restriction) as an adjunct to or substitute for drug therapy for hypertension.

National Institute of Dental Research

The nutrition priorities of the NIDR include the following studies: to eliminate the detrimental effects of dietary sucrose by developing suitable substitutes or by blocking the cariogenic activity of sucrose; to determine the extent to which poor nutrition contributes to periodontal disease; to determine the effects of poor nutrition on the functional integrity, metabolism, and disease of oral mucous membranes; to define the role of nutrition in craniofacial malformation and developmental defects of oral-facial structures; and to determine the effect of nutrition on salivary gland development and function, including secretory immune mechanisms. In the area of soft tissue stomatology and nutrition, research will be conducted in the area of bone biology, on the etiology and prevention of oral ulcerative diseases, and on immunization against infections. Plans also include training for nutrition research related to oral diseases.

National Institute of Arthritis, Diabetes, and Digestive and Kidney Diseases

The NIADDK has the following priorities in nutrition: prevention and control of obesity with emphasis on causal factors relating to eating behavior, energy utilization and differentiation of types of obesity, with the aim toward more effective individualized obesity prevention; development of methodology for early detection of clinical malnutrition in hospitalized patients and ways to enhance their nutritional status and response to therapy; basic studies on the effects of dietary fiber on digestion, absorption, nutrient bioavailability, food transit time, and microbial conversions; quantitation of human nutritional requirements and study of factors that influence them; fundamental studies employing new technologies on the active forms and metabolic functions of nutrients as they may relate to health and disease; the health consequences of iron deficiency; studies on desirable dietary levels and essential role of certain trace minerals (zinc, copper, selenium, etc.); research on the relationship of nutritional status, immune competence and infection; and studies on the interaction of nutrients and drugs.

Obesity prevention demands high priorities in NIADDK research because of the massive public health significance of the problem. Obesity is closely related to increased incidence of atherosclerosis and the increased mortality and morbidity from hypertension, diabetes, gallbladder disease, certain forms of kidney disease, and other disorders. Obesity also tends to exacerbate the discomfort from arthritis, gout and other diseases. The underlying, fundamental causes of most obesity remain obscure, and most control measures used to date have failed to maintain weight loss.

The NIADDK goal is to develop effective measures to foster prevention and control of obesity with programs based on an understanding of the relationships between genetic predisposition, induced metabolic changes, thermogenesis, environmental and physiological factors, and lifestyles that result in greater energy intakes than expenditures. A workshop is planned for October 17-19, 1982 to develop a physiologically valid and clinically applicable classification of obese states. Such a classification scheme to causally differentiate obese subjects will then be tested in a multicenter intervention trial to evaluate its utility for individualization of therapy.

With regard to ways to improve supportive nutrition of hospitalized patients, the NIADDK research efforts are aimed toward the development of improved methodologies for nutritional status assessment and the acquisition of more complete information about the effects of disease states on the nutritional needs of patients. The goal is to develop rapid, improved systems for assessing nutritional status that involve automated assays on small-volume samples of blood or urine for vitamins, trace elements, and electrolytes. Emphasis is placed on delivering the proper quality and quantity of nutrients to treat specific disease states. Adequate nutrition support services offer new, cost-effective approaches in the treatment of many diseases through reduction in mortality, morbidity, and duration of hospitalization. A new program of Clinical Nutrition Research Units has been initiated which will better acquaint physicians with assessment techniques and the application of nutrition in medical care, thus leading to the effective integration of nutrition in medical school curriculum and the stimulation of related clinical nutrition research.

The NIADDK is currently funding five Clinical Nutrition Research Units.

Increased emphasis is being placed on basic studies of the role of dietary fiber because of its suggested relationship to the diseases such as diverticulosis, colonic cancer, and coronary artery disease. Research is being conducted on the chemical characterization of dietary fiber; its effect on intestinal microflora and food transit time; its interaction with nutrients, bile acids, and other substances in the gut; and its effect on digestive enzymes and absorption. Priority is also given to research designed to develop improved routine methods for analysis of dietary fiber components.

Information is inadequate regarding dietary requirements and safe levels of many nutrients for maintenance, growth, development, and well-being at all stages of the life cycle, and for various conditions, including stress, drug use, nutrient imbalances, and activity levels. Nutrients of particular concern are the trace minerals, certain vitamins, dietary fiber, essential amino acids, and total protein. Immediate research goals are to determine the range of safe levels for those nutrients suspected of being involved in dietary inadequacies, imbalances, or toxicities. Special efforts are being directed toward determining whether populations living under conditions of continuous environmental and physiological stress can adapt to lower levels of intake without undue impairment of health and performance.

NIADDK is concerned with the elaboration of the basic function of nutrients and the role of diet in the etiology of major health problems. Many important solutions to nutrition/health related problems can be derived only from fundamental studies such as those on the mechanism of action of nutritional factors in absorption and metabolism, the biological control of such processes, and the identification of as-yet unrecognized roles of nutrients on their metabolites. This area is especially appropriate for emphasis because of recent technological advances (including mass spectrometry, high pressure liquid chromatography, and radioimmunoassay), that should permit rapid progress in such basic studies.

The NIADDK, in a special health research cooperative effort with the National Center for Health Statistics (NCHS), will cooperate with the NCHS's Health and Nutrition Examination Survey (HANES) to obtain epidemiologic data on the relationship of diet to the development of gallstones in both hispanic and general populations of the U.S.

Continued emphasis in the area of iron deficiency is necessary because of the widespread nature of the problem. Severe iron deficiency anemia appears to impair health and physical performance, and occurs in all population groups, ages, races, sexes, and economic levels. Studies are concerned with better evaluation of the detrimental effects of iron deficiency, including work capacity and performance, physical and mental development and function, susceptibility to infection, and perinatal morbidity and mortality.

An additional priority for NIADDK involves investigations of trace mineral nutrition. The recognition of the essential nature of an ever-increasing number of trace elements is of considerable concern. Results of animal studies and experience with hyperalimentation have revealed the limited knowledge regarding requirement levels and metabolic roles of trace minerals. NIADDK research concentrates on the development of accurate, rapid, and reliable analytical methods. Other studies emphasize the metabolic role of the different trace mineral elements and the range of their quantitative requirements. Interactions among trace elements and between specific trace elements and other nutrients receive special attention. The role of flourine in prevention and control of osteoporosis is being studied.

The interaction of nutrition, immune competence, and infection is receiving priority attention at the request of the U.S.-Japan Malnutrition Panel. The extent to which malnutrition interferes with, or augments, host-defense mechanisms will be better defined. Well designed control studies are needed that will characterize nutritional status and the cell-mediated and humoral immune responses to viral, bacterial, and parasitic infections in defined human populations.

National Institute of Neurological and Communicative Disorders and Stroke

The NINCDS is responsible for studying and clarifying the two-way interaction between nutrient intake and activity of the central nervous system. Since the brain depends on glucose for normal functioning, neuroscience research in nutrition attempts to unveil the role of nutrition in the functioning of the nervous system. In addition, the blood-brain barrier excludes most circulating solutes and nutrients from reaching the central nervous system, and only small amounts of nutrients are stored in the central nervous system.

Nutrition studies in molecular biology, hemodynamics, and immunochemistry of the nervous system form the basis of many clinical investigations. Studies are being done on the effect of food additives, especially lipophilic acids, on the growth and differentiation of human cells in culture, and on vitamin requirements of bacterial and mammalian cells during differentiation and specialization. Studies in rhesus monkeys are looking at the effects of protein-calorie malnutrition during pregnancy on possible sensory, pathological, immunological, and biochemical disturbances in the infant.

Various studies consider dietary manipulations and dietary habits in persons with hereditary metabolic disorders that can cause neurological abnormalities. Dietary manipulations are being studied in patients with transient or definite strokes who have either type two or type four hyperlipoproteinemia. Studies are being done on the relationship between dietary habits of various primitive cultures and the incidence of slow virus infections such as Creutzfeldt-Jakob disease, Alzheimer's disease, and amyotrophic lateral sclerosis; on abnormalities in gastrointestinal absorption and hereditary sensory neuropathy; and in children, on the treatment and control of seizures with high fat diets.

From the collaborative perinatal data, attempts are being made to determine the relationship between preconceptual and perinatal factors such as maternal height and weight, diabetes, hypertension, anemia, and the outcome of pregnancy (height, weight, and chest circumference of the infant, and the incidence of cerebral palsy, congenital malformations, mental retardation, minimal brain dysfunction or seizures).

In collaboration with the World Health Organization, epidemiological studies in less developed countries are looking at nutritional factors in relation to nervous system disorders.

National Institute of Allergy and Infectious Diseases

The nutrition priorities of the NIAID include the following studies: definition of the relationship of food allergies and the immune response to ingested antigens, and research on orally induced immunologic response to proteins; determination of the modulating effect of specific nutrients (e.g., vitamins, trace minerals, amino acids, and fatty acids) on basic immune functions; study of the modulating effect of malnutrition on resistance to tropical infections (especially infectious diarrheas), the role of breast milk in defense against enteric infections, and the effect of infections on nutritional status; and research on the role of minerals, especially iron, on the metabolism and virulence of fungi and bacteria.

An additional priority--a study of the interaction between nutrition and infection in American hospitals--is part of the NIAID's overall research program on hospital-associated infections. Included in this priority area are epidemiological studies of hospital-acquired infections and malnutrition in different clinical situations; research on the effect of hypercatabolic illness on immune function and resistance to infections; and studies on the effect of enteral and parenteral nutrition support on immune function and hospital infections.

National Institute of General Medical Sciences

The priority for NIGMS is concerned with research on the role of nutrition in the treatment of patients with trauma and burns. The NIGMS supports studies directed to the discovery of better ways to prevent death from injury, to mitigate pain, to speed recovery of patients, and to lessen the extent of disabilities caused by injuries. In the study of total body response to trauma and burns, research is concerned with the biochemical and physiological changes induced by trauma and with the fundamental aspects of wound healing and biological repair. Emphasis is also given to research on the treatment of post-traumatic infections, the nutritional requirements of patients with burns, and the rehabilitation of injured patients.

National Institute of Child Health and Human Development

The NICHD has the following nutrition research priorities: the relationship of nutrition to reproduction; maternal and fetal nutrition; nutrition during infancy, childhood, and adolescence; behavioral and cultural aspects of nutrition; obesity and the nutritional antecedents of adult disease; nutritional aspects of developmental gastroenterology; and assessment of nutritional status.

With regard to nutrition and reproduction, it is known that nutritional factors affect reproductive functions, but the interrelationships are poorly understood. The major current focus is on the analysis of the effects of vitamins on reproductive functioning and morphology. Additional research in this area includes studies on the relationship between oral contraceptive use and vitamin metabolism, and the role of nutrition in population dynamics.

The NICHD supports a large research program on maternal-fetal nutrition, in which the goal is to achieve better understanding of the complex relationship that exists between the mother and her fetus and the means by which nutrients pass from one to the other. Research focuses on the elucidation of the mechanisms of placental transfer of essential nutrients and on the effects of excessive or deficient amounts of certain nutrients on the development of the fetus. In addition, emphasis is placed on elucidating predictors of intrauterine growth retardation, assessment of the mental development of infants in this condition, and developing models of intrauterine nutritional intervention.

Two research topics in the area of infant nutrition are of particular concern. The first deals with abnormal metabolism, including investigations of the biochemistry and genetics of a variety of inborn errors of metabolism that may be amenable to intervention by dietary means, thus preventing or ameliorating mental retardation. The second research topic in this area is determining daily nutritional requirements and tolerances of infants who are premature or small for gestational age. This work focuses on metabolic processes in neonatal adaptation, on the role of essential nutrients in optimizing early development, and on the effects of breast milk in conveying passive immunity to the young infant. Methods of collecting, storing, processing, and distributing human milk and colostrum through a Human Milk Bank Research Distribution Center are being investigated. Other studies comprise research on parenteral nutrition of newborn infants of low birth weight to enhance nitrogen balance, weight gain, and various aspects of infant brain growth and development.

The NICHD program of adolescent nutrition emphasizes research in the areas of nutrition and the adolescent growth spurt, obesity in adolescence, and nutrition of the pregnant adolescent. Adolescence is a time of profound physical transformation during which growth rates are attained that are exceeded only by those during fetal life and early infancy. Large differences between boys and girls during their growth spurts in demand for calcium and nitrogen have been documented.

Nutritional research challenges in regard to the pregnant adolescent are: to assess accurately her nutritional status; to understand her total nutritional needs and those of her fetus; and to develop nutritional and other interventions to prevent the birth of physically or mentally damaged offspring to mothers who are less than 16 years old.

Recently the NICHD sought to stimulate more research on adolescent nutrition, especially in the area of adolescent eating habits. This aspect of adolescence was emphasized in the program announcement entitled Adolescence Research.

The NICHD program in clinical nutrition and early development is designed to stimulate research on how behavioral, cultural, and social factors affect diet and nutrition. Research focuses on nutritional individuality generated by the interactions between genetic inheritance and the nutritional environment. Research is also pursued on the psychosocial origins of food dislikes and avoidances. Results of such studies are expected to give clinicians a better understanding of nutritional habits and needs, and to provide a scientific base for developing successful programs of dietary modifications.

In the priority area on the nutritional antecedents of adult disease, research focuses on factors in the development of obesity in infancy, childhood, adolescence, and early adulthood. Some of the work examines the effect of early nutrition on the metabolism, cellularity, and development of adipose tissue in both normal and obese children. Epidemiological research is continuing on the normal pattern of fat deposition and on the determination of concomitants and predictors of obesity. In related research, attempts are being made to describe as precisely as possible the natural history of obesity and to determine the ultimate influence in adulthood of dietary intake and food consumption patterns established in infancy and childhood. A new interdisciplinary program involves the search within the central nervous system for mechanisms that control taste preferences, eating and drinking behavior, gastrointestinal function, fat storage, and body composition.

Studies on the nutritional aspects of developmental gastroenterology emphasize basic research on cellular differentiation in relation to the functional development of the intestine. Research is conducted on the important problem of enhancing fetal nutrition by administration of nutrients via the fetal gastrointestinal tract. Other significant projects include: studies on properties of human milk to determine antimicrobial components that act to prevent neonatal infections, hepatobiliary function of the premature infant, trace element absorption and specific ion-binding ligands, digestion and absorption of specific oligopeptides, and possible behavioral determinants of gastrointestinal development.

Studies of nutritional status emphasize the development of new methods for assessing nutritional status in pregnancy, infancy, childhood, and adolescence. The chief aim is to develop methods that are noninvasive and pose the least possible risk to the individual while being precise, economical, and convenient. Investigators supported by the NICHD have pioneered in the development of anthropometric, biochemical and functional measurements of nutritional status. Recently, an oscillating air displacement technique has been developed to ascertain precisely the body volume of infants.

National Eye Institute

The National Eye Institute's major priority in nutrition research is to understand better the relationship between nutritional factors and loss of vision. Much of the research in this area involves vitamin A and its derivatives. The vitamin A derivative, retinal, plays a central role in the conversion of light stimuli to visual impulses by cells of the retina. Prolonged vitamin A and protein deficiency cause two corneal disorders, keratomalacia and xerophthalmia, two major causes of nutritional blindness worldwide.

Another priority involves the study of the therapeutic uses of vitamins and other nutrients in the treatment of ocular diseases and injuries. Vitamin C, for example, has been shown to improve healing of wounds and alkali burns of the cornea. The protective role of vitamin E against induced retinopathies, particularly retrolental fibroplasia, holds great promise for preserving sight in premature infants. Also, because the enzyme aldose reductase has been shown to trigger the onset of cataracts, compounds that inhibit this enzyme are being tested for their ability to prevent the formation of cataracts associated with diabetes and other ocular and systemic complications of this metabolic disease.

Finally, the identification of possible nutrition risk factors for ocular disorders is also an important priority in NEI-supported research.

National Institute of Environmental Health Sciences

NIEHS programs support research in nutrition that is focused on the interactions between environmental contaminants and the nutritional or dietary constituents of biological systems. Thus, for example, toxic agents are studied in fed or fasted animals to learn the pharmacokinetic and toxic effects of dietary balance or specific dietary elements as they interact with the pollutant.

The changing nature of the types and levels of environmental pollutants resulting from alteration in the country's energy usage will necessitate an increased emphasis on synergistic and additive effects of such pollutants on health and nutritional status. Studies will center upon physiological systems involving digestion and the endocrine system.

A number of projects investigate the effects of the intake of heavy metals on the metabolism and balance of essential elements. Conversely, supplementation of essential elements and the subsequent amount in the body may protect against the toxic effects of heavy metals; zinc, for example, has been shown to protect against toxic effects of heavy metals on the liver. Studies are also being done to define the biological functions, accumulation, and transmittal of selenium, an essential but toxic nutrient.

Other studies are supported to determine toxic changes generated in the enterohepatic, biliary and renal systems by environmental contaminants; the decreased absorption and enhanced excretion to prevent this kind of biological insult is being explored.

A second major segment of the NIEHS nutrition activity is comprised of research in food toxicology. Some grantees are studying the toxic effects and biologic mechanisms of natural toxicants such as alkaloids in food plants. Others are looking at mycotoxins and furans, contaminants generated under suboptimal food storage conditions. Food processing hazards such as nitrates and other additives are studied to explore their toxic properties and mechanisms to learn how they are altered in the foodstuffs, and how they are transformed by biological systems. Other studies are supported to measure the uptake, accumulation, and metabolism of toxicants in food crops and plants, and to determine the hazards that may be associated with food processing; for example, determining if toxic or carcinogenic breakdown products are associated with food preparation by frying or grilling.

National Institute on Aging

The NIA has the following research priorities in nutrition: studies in nutrition and epidemiology; research on the effects of psychological, social, and sensory factors on dietary intake and health; studies on the effects of dietary modification on physiologic response, disease, and aging processes; determinations of the influence of nutrition and nutrient utilization on health maintenance and on disease prevention and treatment; research regarding the effects of nutrition on cellular structure and function; and the development of training and biological materials as resources for program development.

Clinical nutrition research is emphasized in studies on the influence of nutrition vis a vis nutrient utilization on health maintenance and on the prevention and treatment of disease. This priority area includes studies on the age-related changes in nutrient utilization; on relationships between nutrition and metabolic processes such as endocrine function, and immune response; and on the interaction among nutrition, drugs, and preventive and surgical procedures. Research is also under way on the effects of nutrition on cellular structure and function with studies supported both in vivo and in vitro cellular and animal models.

Another priority area is research on the effects of dietary modification on physiological responses and aging processes, and on disease. Studies consider the relationship of nutrition and aging to loss of organ function and to acute and chronic diseases prevalent in the aged. Particular areas of emphasis are on the possible dietary and environmental influences on the interruption in the cyclic regularity of rectal and sphincteric function and the effects of aging on the digestive function of the liver and the pancreas.

Epidemiological research in nutrition is a relatively recent program area for the NIA. Studies are being developed for the acquisition and evaluation of baseline data on the aged population, and on their dietary morbidity, and mortality patterns. Followup studies will be conducted in conjunction with the National Center for Health Statistics on individuals previously examined in the Health and Nutrition Examination Survey.

The association between nutritional status and morbidity and mortality of individuals will be studied, and cross sectional data to evaluate the HANES data will be obtained from several reference populations with established demographic health and psychosocial characteristics. This data will provide the baseline for integrated studies of medical, socioeconomical and behavioral aspects of health. Collaborative studies among nutritionists, social scientists, and neuroscientists will provide the basis for studies on the influence or effects of neurological, environmental, and dietary factors on senile dementia or sensory deficits in the elderly.

In the NIA's fourth priority area, research is being expanded on the effects of psychological, social, and sensory factors on dietary intake and health. Emphasis is given to studies on the influence of socioeconomic and psychological factors on the appetite and diet of the elderly.

An area of particular interest is the decline in the senses of smell and taste with age, and its implications for dietary preferences and habits in the elderly.

The fifth priority involves developing research training and biological materials as possible resources within the NIA research program. Efforts to improve research training involve the integration of predoctoral and postdoctoral training with program objectives, and the development of means to attract M.D.'s to research training in clinical investigations, including nutrition.

Manpower development and animal resources are an important part of an expanded research program on nutrition and aging. With regard to manpower development, the NIA has proposed a plan for research on nutrition and aging based on three alternate levels of support; the plan includes training for clinical research on issues dealing with nutrition in the elderly as well as basic scientific training. In the development of animal resources, the NIA, in cooperation with the Division of Research Resources, will continue to plan for the development of a resource of aged nonhuman primates.

Division of Research Resources

DRR will continue to supply the resources for many of the research projects planned by the other Institutes in its General Clinical Research Centers (GCRC) Program. Important areas in which research will be done on GCRC's program include: nutrition in debilitated cancer patients; study of human milk nutrients and development of infant formulas, especially for prematures; nutrition in diabetic women during pregnancy; dietary regimen and exercise in obesity; zinc requirements in the aged; parenteral nutrition in the postsurgical patient; diet modification in the prevention of heart disease; and suitable diets for athletes. Also more GCRCs will receive computer systems specifically designed for clinical research, which will assist the dietitians in calculating diets and which will provide additional opportunity to study dietary patterns in ambulatory patients.

In the Primate Research Centers Program (PRCP), basic studies will continue on the long-term effects of varied levels of dietary protein on plasma lipoprotein concentrations and metabolism in nonhuman primates. This work is based on the hypothesis that long term ingestion of low protein diets results in retarded hepatic metabolism of estrogen. Rates of metabolism of low-density and high-density lipoproteins in various tissues are also being determined. In another study, the elevating effects of high salt diets on blood pressure levels in infant monkeys and the mechanisms involved will be pursued.

The Biomedical Research Support Grant (BRSG) Program enhances the quality, increases the productivity, and reduces the cost of biomedical research at the nation's research organizations, health professional schools, academic institutions, and research hospitals. Unlike NIH research project grants, BRSG grants are designed for flexible use at the discretion of the grantee institution. Studies will continue to test the validity of new ideas and the feasibility of research methods. Typical pilot studies cover a broad area of nutrition research, including studies on:

(1) Causes and effects of poor nutrition and cigarette smoking,

(2) Neural mechanisms controlling the pancreas in diabetes and obesity,

(3) Nutritional rehabilitative status of cancer chemotherapy patients,

(4) Vitamin A and hyperlipidemia, and

(5) Anorexia nervosa: Some psychological and perceptual factors.

APPENDIX E

LEGISLATIVE AUTHORITY OF NIH FOR HUMAN NUTRITION RESEARCH

Two Institutes have specific mandates to conduct nutrition research at the NIH. Those mandates are as follows (references are to PHS Act):

NCI: Section 407(b)(4)--"Collect, analyze, and disseminate information (including information respecting nutrition programs for cancer patients and the relationship between nutrition and cancer) useful in the prevention, diagnosis, and treatment of cancer, including . . ."

NHLBI: Section 413(a)(1)--"investigation into the epidemiology, etiology, and prevention of all forms and aspects of heart, blood vessel, lung, and blood diseases, including investigations into the social, environmental, behavioral, nutritional, biological, and genetic determinants and influences . . ."

Section 413(d)--"There shall be in the Institute an Assistant Director for Prevention, Education and Control . . . In the conduct of such a program, special emphasis shall be placed upon dissemination of information regarding diet, exercise, stress, cigarette smoking, weight control . . ."

Other Institutes that conduct and support nutrition research do so under much broader authority. Each conducts research programs in the "diagnosis, prevention, and treatment" of specific diseases and life processes within their areas of responsibility. Those authorities are as follows:

General authority	Section 301
International cooperation authority	Section 307
Training authority	Section 472(a)(1)(a)
NCI	Section 402(a)
NHLBI	Section 412(1)
NIDR	Section 422(a)
NIADDK	Section 434(c) Section 435(a) Section 439(a)
NICHD	Section 441(a)
NIGMS	Section 442
NIA	Section 464
Other Institutes	Section 431(b)

NCI LEGISLATIVE AUTHORITY FOR NUTRITION INFORMATION AND EDUCATION PROGRAMS

The specific mandates of the NCI for nutrition information and education programs are contained in Section 407(b)(4) of Public Law 92-218, "The National Cancer Act of 1971," as amended in Public Law 93-352, "Title I - Extension of Cancer Program":

> P.L. 92-218, Section 407(b)(4): "Collect, analyze, and disseminate all data useful in the prevention, diagnosis, and treatment of cancer, including the establishment of an international cancer research data bank to collect, catalog, store, and disseminate insofar as feasible the results of cancer research undertaken in any country for the use of any person involved in cancer research in any country."

> P.L. 93-352, Section 103: "Section 407(b)(4) of the Public Health Service Act is amended by striking out 'all data' and inserting in lieu thereof 'information (including information respecting nutrition programs for cancer patients and the relationship between nutrition and cancer).'"

NHLBI LEGISLATIVE AUTHORITY FOR NUTRITION INFORMATION AND EDUCATION PROGRAMS

The specific mandates of the NHLBI for nutrition information and education programs can be found in Section 413 of the Public Health Service Act, March 1977. This Section indicates the general plan for the Institute to expand, intensify, and coordinate the Institute's activities in the areas of heart, blood vessel, lung, and blood diseases and blood resources. To implement this mandate, Section 413(a)(1) states:

> "Investigation into the epidemiology, etiology, and prevention of all forms and aspects of heart, blood vessel, lung, and blood diseases, including investigations into the social, environmental behavioral, nutritional, biological, and genetic determinants and influences involved in the epidemiology, etiology, and prevention of such diseases."

Section 413(d) states the following:

> "There shall be in the Institute an Assistant Director for Prevention, Education, and Control who shall be appointed by the Director of the Institute. The Director of the Institute, acting through the Assistant Director for Prevention, Education, and Control, shall conduct a program to provide the public and the health professions with health information with regard to cardiovascular and blood and pulmonary diseases and blood resources. In the conduct of such program, special emphasis shall be placed upon dissemination of information regarding diet, exercise, stress, hypertension, cigarette smoking, weight control, and other factors affecting the prevention of arteriosclerosis and other cardiovascular diseases and of pulmonary and blood diseases."

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DISCRIMINATION PROHIBITED: Under provisions of applicable public laws enacted by Congress since 1964, no person in the United States shall, on the grounds of race, color, national origin, handicap, or age, be excluded from participating in, be denied benefits of, or be subjected to discrimination under any program or activity (or, on the basis of sex, with respect to any education program or activity) receiving Federal financial assistance. In addition, Executive Order 11141 prohibits discrimination on the basis of age by contractors and subcontractors in the performance of Federal contracts, and Executive Order 11246 states that no federally funded contractor may discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. Therefore, the Nutrition Coordinating Committee must be operated in compliance with these laws and Executive Orders.

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